ERRATA NOTICE

EOS Core System (ECS) Project Contract No. NAS5-60000

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Document No.:   305-CD-037-002

Title: Release B ORNL DAAC Design Specification for the ECS Project

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Remove	Insert
3-23 through 3-26	3-23 through 3-26
3-39 through 3-40	3-39 through 3-40

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305-CD-037-002

EOSDIS Core System Project

Release B ORNL DAAC Design Specification for the ECS Project

March 1996

Hughes Information Technology Systems
Upper Marlboro, Maryland

Release B ORNL DAAC
Design Specification
for the ECS Project

March 1996

Prepared Under Contract NAS5-60000
CDRL Item #046

APPROVED BY

Rick Kochhar /s/   3/29/96

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EOSDIS Core System Project

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305-CD-037-002

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Preface

This document is one of nineteen comprising the detailed design specifications of the SDPS and CSMS subsystem for Release B of the ECS project. A complete list of the design specification documents is given below. Of particular interest are documents number 305-CD-020, which provides an overview of the subsystems and 305-CD-039, the Data Dictionary, for those reviewing the object models in detail. A Release B SDPS and CSMS CDR Review Guide (510-TP-004-001) is also available.

The SDPS and CSMS subsystem design specification documents for Release B of the ECS Project include:

305-CD-020-002   Release B Overview of the SDPS and CSMS Segment System Design Specification

305-CD-021-002   Release B SDPS Client Subsystem Design Specification

305-CD-022-002   Release B SDPS Interoperability Subsystem Design Specification

305-CD-023-002   Release B SDPS Data Management Subsystem Design Specification

305-CD-024-002   Release B SDPS Data Server Subsystem Design Specification

305-CD-025-002   Release B SDPS Ingest Subsystem Design Specification

305-CD-026-002   Release B SDPS Planning Subsystem Design Specification

305-CD-027-002   Release B SDPS Data Processing Subsystem Design Specification

305-CD-028-002   Release B CSMS Segment Communications Subsystem Design Specification

305-CD-029-002   Release B CSMS Segment Systems Management Subsystem Design Specification

305-CD-030-002   Release B GSFC Distributed Active Archive Center Design Specification

305-CD-031-002   Release B LaRC Distributed Active Archive Center Design Specification

305-CD-033-002   Release B EROS Data Center Distributed Active Archive Center Design Specification

305-CD-034-002   Release B ASF Distributed Active Archive Center Design Specification

305-CD-035-002   Release B NSIDC Distributed Active Archive Center Design Specification

305-CD-036-002	Release B JPL Distributed Active Archive Center Design Specification
305-CD-037-002	Release B ORNL Distributed Active Archive Center Design Specification
305-CD-038-002	Release B System Monitoring and Coordination Center Design Specification
305-CD-039-002	Release B Data Dictionary for Subsystem Design Specification

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Any questions should be addressed to:

Data Management Office
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Abstract

The Release-B Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) Design Specification describes the ECS subsystems at the ORNL ECS DAAC. ECS Subsystem-Specific Design Specifications provide detailed design descriptions of the subsystems. This document shows the specific implementation of that design at the ORNL ECS DAAC, including the identification of the specific software, hardware and network configuration for the ORNL ECS DAAC.

Keywords: ORNL, DAAC, configuration, design

305-CD-037-002

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Change Information Page

List of Effective Pages	
Page Number	**Issue**
Title	Submitted as Final
iii through viii	Submitted as Final
1-1 through 1-4	Submitted as Final
2-1 through 2-2	Submitted as Final
3-1 through 3-60	Submitted as Final
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Contents

4. Future Releases

Figures

Tables

Abbreviations and Acronyms

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1.   Introduction

1.1 Identification

This Release B ORNL DAAC Design Specification for the ECS Project, Contract Data Requirement List (CDRL) Item 046, with requirements specified in Data Item Description (DID) 305/DV2, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

1.2 Scope

Release B of ECS supports functional capabilities and services required to meet driving requirements and milestones including:

- Functionality/services required to support mission operations for the continuation of TRMM, as well as the initiation of LANDSAT 7, COLOR, ADEOS II, and EOS AM-1. This includes planning and scheduling, command and control, production data processing, data distribution and other ECS functions.

- Functionality/services required to support mission operations for the initiation of SAGE III (METEOR) and ACRIM Flight-Of-Opportunity (FOO). This includes production data processing, data distribution and other ECS functions.

- Provide information management, data distribution and a high level archive for the SAR data from the ERS-1/2, JERS-1 and RADARSAT spacecraft.

- Functionality/services required to support EOS ground system interface testing which includes end-to-end mission simulations, communication services for EBnet, network management services and other ECS services.

- Functionality/services required for V0 Interoperability.

- Functionality/services required for Science Software I&T Support for TRMM, LANDSAT 7, COLOR, ADEOS II, EOS AM-1, SAGE III FOO, ACRIM FOO, Space Station, and EOS PM-1.

Several of the driving requirements and milestones were initially supported by Release A but are expanded upon for Release B. For example, infrastructure Data Flow and End-to-End Testing and Simulation Readiness Testing were supported early-on by Release A, and is fully supported by Release B during the final phases of testing. Likewise, V0 interoperability (one way) is supported by Release A for GSFC, LaRC and EDC DAACs and is expanded to two way interoperability for all DAACs at Release B.

ECS will provide support to eight Distributed Active Archive Centers (DAACs). The DAACs are tasked with generating EOS standard data products and carrying out NASA's responsibilities for data archive, distribution and information management. The DAACs serve as the primary user

interface to EOSDIS. These DAACs are located at: Goddard Space Flight Center (GSFC) Greenbelt, MD; Langley Research Center (LaRC) Hampton, VA; Oak Ridge National Laboratory (ORNL) Oak Ridge, TN; EROS Data Center (EDC) Sioux Falls, SD; National Snow and Ice Data Center (NSIDC) Boulder, CO; Jet Propulsion Laboratory (JPL) Pasadena, CA; the Consortium for International Earth Science Information Network (CIESIN) in University Center, MI; and the Alaska SAR Facility (ASF) at the University of Alaska Fairbanks.

This document is part of a series of documents comprising the Science and Communications Development Office (SCDO) design specification for the Communications and System Management segment (CSMS) and the Science and Data Processing Subsystem (SDPS) for Release B. The series of documents include an overview, a design specification document for each subsystem, and a design implementation document for each DAAC involved in the release, as well as one for the System Monitoring and Coordination (SMC) center.

This document specifically focuses on the ORNL DAAC ECS configuration and capabilities at Release B. It is released, and reviewed at the formal Release B Critical Design Review (CDR).

This document reflects the February 14, 1996 Technical Baseline maintained by the contractor configuration control board in accordance with ECS Technical Direction No. 11, dated December 6, 1994.

1.3 Purpose

The purpose of this document is to show the elements of the Release B ECS science data processing and communications design and implementation that will support the ECS portion of the ORNL DAAC in meeting its objectives. The Release B Overview of SDPS and CSMS (305-CD-020-002) provides an overview of the ECS subsystems and should be used by the reader in order to get a basic understanding of ECS design components. The Release Plan Content Description document (222-TP-003-008) provides a detailed mapping of functional capabilities and services that will be available for each release. While some DAAC configurations vary depending on the mission/capability requirements for ECS at their DAAC, the ORNL DAAC will include all of the ECS communications and science data processing subsystems except the archive and distribution, and the planning and data processing subsystems.

1.4 Status and Schedule

This submittal of DID 305/DV2 meets the milestone specified in the Contract Data Requirements List (CDRL) for Critical Design Review (pre-CDR) of NASA Contract NAS5-60000. The submittal will be reviewed during the Release B (CDR) and changes to the design which resulted from that review will be reflected in subsequent updates.

1.5 Document Organization

This document is organized to describe the design of the ECS portion of the ORNL DAAC as follows:

Section 1 provides information regarding the identification, scope, status and schedule, and organization of this document.

Section 2 provides a listing of the related documents which were used as source information for this document.

Section 3 provides a description of the ECS design at the ORNL DAAC. It includes a description of the DAAC external interfaces, ECS software implementation, including identification of Off the Shelf (OTS) products, hardware configuration and operational activities.

- Subsection 3.1 establishes the context for the technical discussions with an overview of the specific ECS portion of the ORNL DAAC mission and ORNL Release B operations. It identifies the key ECS related mission and operations activities that are supported via the ECS functionality at the DAAC.

- Subsection 3.2 addresses the external interfaces of the ECS subsystems as implemented at ECS portion of the ORNL DAAC. The ORNL unique interface is that with the ORNL DAAC unique system for metadata migration, archive and distribution for data holdings offered through the ORNL DAAC .

- Subsection 3.3 provides a software component analysis. There are 10 ECS data processing and communications subsystems that contain Hardware Configuration Items (HWCIs) and Computer Software Configuration Items (CSCIs). This section addresses the CSCIs and their corresponding lower level Computer Software Components (CSCs). The CSCs are described in detail in their respective subsystem design specification documents. In this section, the CSCs are captured in a single table, broken down by Subsystem/CSCI. The table lists the CSCIs and the associated CSCs. Notes are provided to expand upon generic explanations from the body of the Subsystem Design Specifications to describe what makes the particular CSC specific to the DAAC. In addition, when a CSC is identified as Off-the-shelf (OTS), the candidate product is identified.

- Subsection 3.4 provides a DAAC specific discussion of the ECS data processing and communications Hardware Configuration Items (HWCIs). This section identifies the HWCI components and indicates the specific components and quantities that are resident at the DAAC. It includes the Local area network (LAN) configuration and the rationale for the specific hardware configuration.

- Subsection 3.5 provides a software to hardware configuration mapping.

Section 4 gives a description of what can be expected in the next release of ECS.

Appendix A provides detailed configurations for the Data Processing Subsystems's Science Processing hardware suite.

The section, Abbreviations and Acronyms, contains an alphabetized list of the definitions for abbreviations and acronyms used in this document.

305-CD-037-002

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2. Related Documentation

2.1 Parent Documents

The parent documents are the documents from which the scope and content of this Release B ORNL DAAC Design Specification are derived.

194-207-SE1-001   System Design Specification for the ECS Project

209-CD-022-002   Interface Control Document Between EOSDIS Core System (ECS) and the Oak Ridge National Laboratory DAAC for the ECS Project

305-CD-020-002   Release B SDPS/CSMS Design Specification Overview for the ECS Project

305-CD-021-002   Release B SDPS Client Subsystem Design Specification for the ECS Project

305-CD-022-002   Release B SDPS Interoperability Subsystem Design Specification for the ECS Project

305-CD-023-002   Release B SDPS Data Management Subsystem Design Specification for the ECS Project

305-CD-024-002   Release B SDPS Data Server Subsystem Design Specification for the ECS Project

305-CD-025-002   Release B SDPS Ingest Subsystem Design Specification for the ECS Project

305-CD-026-002   Release B SDPS Planning Subsystem Design Specification for the ECS Project

305-CD-027-002   Release B SDPS Data Processing Subsystem Design for the ECS Project

305-CD-028-002   Release B CSMS Communications Subsystem Design Specification for the ECS Project

305-CD-029-002   Release B CSMS Systems Management Subsystem Design for the ECS Project Specification

305-CD-039-002   Release B Data Dictionary for the ECS Project Subsystem Design for the ECS Project

311-CD-003-005   CSMS Database Design and Database Schema Specifications for the ECS Project

2.2   Applicable Documents

The following documents are referenced within this Subsystem Specification, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this document.

206-CD-001-002	Version 0 Analysis Report for the ECS Project
209-CD-001-002	Interface Control Document Between EOSDIS Core System (ECS) and the NASA Science Internet for the ECS Project
209-CD-011-004	Interface Control Document Between EOSDIS Core System (ECS) and the Version 0 System for the ECS Project
304-CD-002-002	SDPS Requirements Specification for the ECS Project
305-CD-038-002	Release B System Monitoring and Coordination Center Design Specification for the ECS Project
313-CD-006-002	Release B CSMS/SDPS Internal Interface Control Document for the ECS Project
403-CD-002-001	Release B Verification Specification for the ECS Project
409-CD-002-001	Release B Overall System Acceptance Test Plan for the ECS Project
604-CD-001-004	Operations Concept for the ECS Project: Part 1-- ECS Overview
604-CD-002-003	Operations Concept for the ECS project: Part 2B -- ECS Release B
604-CD-003-002	Operations Concept for the ECS Project: Part 2A -- ECS Release A
604-CD-004-001	Operations Concept for the ECS Project: Part 2 -- FOS
605-CD-002-001	Release B SDPS/CSMS Operations Scenarios for the ECS Project
615-CD-002-001	Release B Special Maintenance and Test Equipment for the ECS Project
622-CD-001-002	Training Plan for the ECS Project
160-TP-004-001	User Pull Analysis Notebook [for the ECS Project]
194-TP-312-001	User Characterization and Requirements Analysis [for the ECS Project]
210-TP-001-006	Technical Baseline for ECS Project
222-TP-003-008	Release Plan Content Description for the ECS Project
420-TP-001-005	Proposed ECS Core Metadata Standard Release 2.0, Technical Paper
420-TP-010-002	Transition to Release B, Technical Paper

3. ORNL DAAC Configuration

3.1 Introduction

3.1.1 ORNL DAAC Overview

The ORNL Distributed Active Archive Center (ORNL DAAC) is one of the eight DAACs that are part of the NASA Earth Observing System Data and Information System (EOSDIS). These DAACs are organized to support specific scientific disciplines. The objective of the ORNL DAAC is to archive science data and provide support services to its users in the discipline areas of ground-based ecological and biogeochemical dynamics. Such data and information includes the biological and physical processes and conditions that govern the storage and fluxes of energy, water, trace gases, carbon, nutrients, and other elements in the ecosystems. Data from the ORNL DAAC can be used to calibrate and verify remote sensing data and to parameterize and validate models of local, regional, and global processes for projecting changes in the earth's ecosystems.

A major design driver that shaped the design for the ORNL ECS DAAC is the Version 0 and DAAC-specific activities. The ORNL DAAC helps people realize the scientific and educational potential of the global climate data accessed through the DAAC. In addition to providing user interface through Version 0, the ORNL DAAC, in close concert with the ORNL User Working Group, developed a search and order information management system, the ORNL IMS. The ORNL DAAC system was developed, and is still being developed, to enhance and improve scientific research and productivity by consolidating access to biogeochemical dynamics earth science data, as well as by providing services that provide added value to the data.

The ORNL DAAC supports over 170 data sets/products which are developed from heritage data centers, as well as ongoing field campaigns/projects concerned with ground-based data. The ORNL DAAC-specific system is constantly adding new data sets, and will continue to archive and distribute a variety of Earth science products. To support the EOSDIS ongoing missions, parallel operation of the DAAC-specific system and the ECS Release will occur to ensure full access to existing datasets and services.

The equipment and software suites will be provided as part of the implementation of Release B to support mission operations of TRMM, LANDSAT 7, COLOR, ADEOS II, EOS AM-1, the V0 interoperability and simulation readiness testing. The Release Content Plan provides a description of the missions and the driving requirements which must be satisfied to support these missions. This document provides a description of the ECS design components that are specific for the ORNL DAAC. This document also elaborates upon design-generic components that are of special interest to the ORNL users, data producers, and DAAC staff.

This Release B Design Specification establishes the ORNL DAAC ECS configuration and capabilities at Release B. These capabilities are selected from two ECS design segments referred to as the Science Data Processing Segment (SDPS) and the Communications and Systems Management Segment (CSMS). More specifically, this document addresses how the ORNL's Release B version of SDPS will provide the hardware, software, and operations to:

305-CD-037-002

- manage in situ correlative data;

- provide the Earth science community with access to data held by the ECS and the data products resulting from research using these data; and

- support migration of V0 data and to promote exchange of data and research results within the science community and across the multi-agency/multi-national data collection systems and archives.

Likewise, this document addresses how the ORNL Release B version of CSMS will provide the hardware, software, and operations to:

- support status exchange between various sites, and the DAACs for both operational and test efforts; and

- provide full functionality and performance for all System Management functions.

Figures 3.1.1-1 and 3.1.1-2 illustrate the SDPS and CSMS subsystems and their components for Release B. The bulk of this document focuses on the selected elements of the ECS design that are used to achieve Release B objectives at the DAAC. Section 2.1 of this document identifies CDR Design Specifications which provide detailed information on each subsystem.
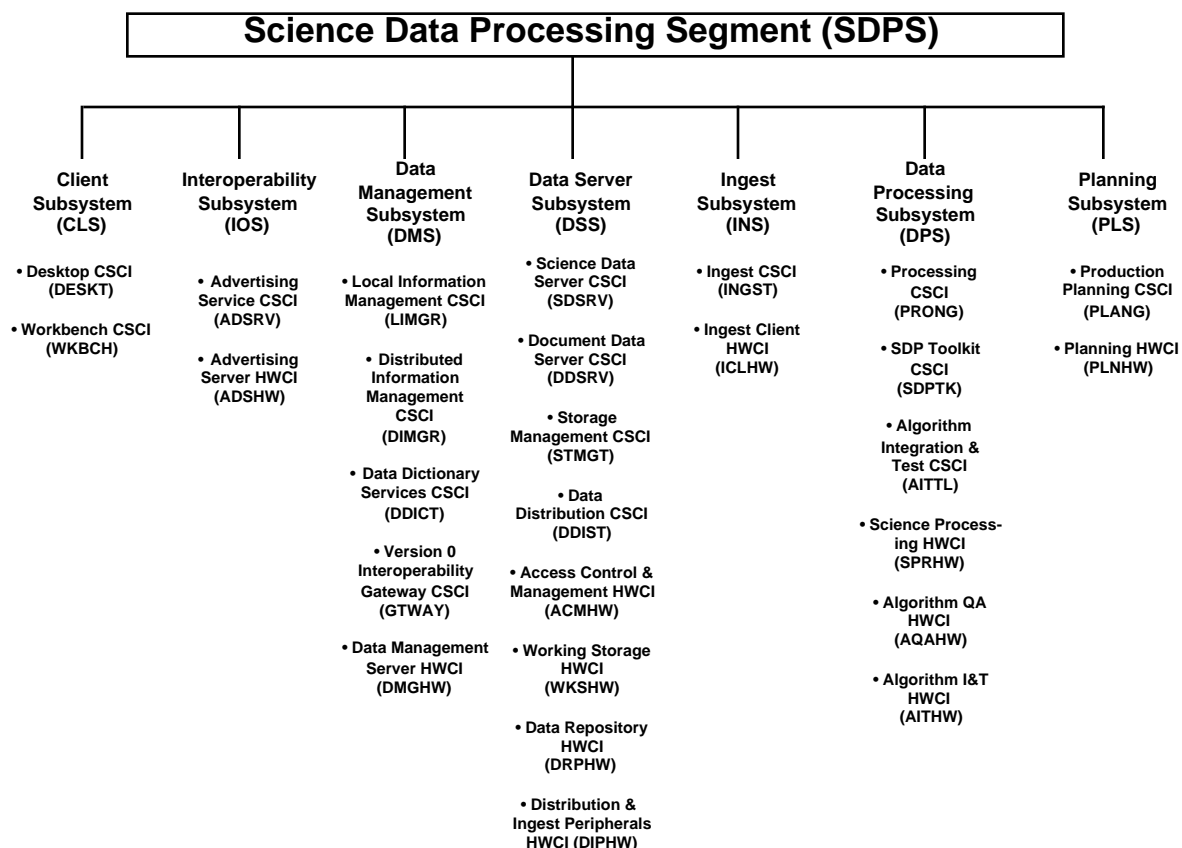
Figure 3.1.1-1.   SDPS Subsystems and Configuration Items

305-CD-037-002

```
┌─────────────────────────────────────────────────────────────────────┐
│  Communications and System Management Segment                       │
│                                                                       │
│                                                                       │
│        Communcations        Management         Internetworking        │
│         Subsystem           Subsystem            Subsystem             │
│           (CSS)                (MSS)                (ISS)               │
│                                                                       │
│     • Distributed Computing  • Management      • Internetworking       │
│         Software CI            Software       Configuration Item       │
│           (DCI)           Configuration Item        (INCI)             │
│                                (MCI)          • Internetworking        │
│     •Distributed Computing                      Hardware CI            │
│         Hardware CI          • Management           (INCI)             │
│           (DCHCI)             Logistics                                │
│                          Configuration Item                           │
│                                (MLCI)                                  │
│                                                                       │
│                              • Management                             │
│                                Agents                                 │
│                          Configuration Item                           │
│                                MACI                                   │
│                                                                       │
│                              • Management                             │
│                               Hardware CI                            │
│                                (MHCI)                                 │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 3.1.1-2.   CSMS Subsystems and Components **3.1.2   DAAC-Specific Mission and Operations Activities**

The objectives of the Release B at ORNL are to provide ECS components for:

- ECS Information and System management;
- Independent Verification and Validation (IV&V) Support;
- V0/ADC Interoperability;
- Version 0 Data Migration; and
- DAAC Site Activation.

ECS Information and System Management: ECS will be fielding the full suite of CSMS services to ORNL. This includes enterprise management for ECS-provided components; interoperability and information transfer between clients and servers; and LAN connections among ECS components and a network interface to other ORNL networks. From the SDPS side, ECS will be providing the Data Management Subsystem which includes LIM, DIM and data dictionary services; the Interoperability subsystem which provides the advertising service; the Client subsystem which includes the desktop and scientist workbenches; a subset of the Data Server subsystem including the Science Data Server service, the Document Data Server Service, the Data Type service, and the administration and schema generation services to support management, storage and searching of metadata; and a subset of the Ingest subsystem to support the ingest of metadata into ECS.

Independent Verification and Validation (IV&V) Support: Prior to the Release Readiness Review (RRR), the IV&V contractor can witness and/or monitor release acceptance testing and document nonconformances. Upon successful completion of the RRR, the IV&V contractor verifies that the ECS release operates correctly within the EOS Ground System (EGS). The ECS contractor, specifically the Independent Acceptance Test Organization (IATO), supports the IV&V contractor in this effort for a period of one month following RRR at the operational sites. The IATO coordinates personnel, facilities, and equipment support in the resolution of ECS nonconformances identified during IV&V testing. ECS contractor Maintenance and Operations personnel also support IV&V activities at operational centers, as necessary.

V0/ADC Interoperability: Two-way interoperability involves two different capabilities. First, outgoing interoperability allows users to log into the ECS and access ECS services, including the ability to access non-ECS data products from a site external to ECS directly from the ECS user interface. Second, incoming interoperability allows users, who are logged into a non-ECS site, to access ECS data products directly from the non-ECS user interface, using non-ECS IMS services.

Two-way Version 0 interoperability prior to the transition from Version 0 to Version 1 ECS is required to ease the transition process. One-way interoperability with ADCs (ECS to ADCs) is also required early to ease the Version 0 transition. Two-way interoperability with ADCs is a mission fulfillment capability since it is not required for TRMM or EOS AM-1 mission support.

Building from Version 0: Building on Version 0 for a release implies that the release will be capable of matching (in general) the functionality of Version 0 plus adding some features that Version 0 does not have (i.e., building on to (or enhancing) existing Version 0 capabilities). This does not mean the release will match every individual function/capability of Version 0. It will be possible (through interoperability) to access some Version 0 functions, without having to make them part of ECS.

The ECS Version 1 (V1) Client will be implemented in Release B, and will completely replace the V0 Client implemented in Release A. In Release B, ECS will deploy an infrastructure that exceeds that in V0, and which will provide the foundation from which to add future enhancements which exceed V0.

Version 0 (V0) Data Migration: Version 0 (V0) data migration includes the ability to transition V0 metadata from V0 to V1; and provide support, data management, search, and access capabilities for these metadata.

DAAC Site Activation: The EOSDIS DAACs have the mission of processing, archiving and distributing earth science data. While ECS will be providing tools to support the DAAC's mission in Release B, many DAACs, like the ORNL DAAC, are currently performing these functions now.

The ECS contractor will schedule a series of site coordination trips to all DAACs. The objective of these trips is to ensure that the ECS contractor and the DAAC managers are in agreement with all operational issues. When ECS starts to deliver its systems to the sites, ECS works with the host organizations to ensure that hardware and software installation and segment and system testing all occur in a pre-planned manner that is sensitive to the

mission of the host organization. Coordination topics include facility requirements, locations of ECS equipment and personnel, installation and test periods, etc.

The maintenance and operations (M&O) personnel at ORNL includes only host organization personnel. Training of the M&O personnel to operate, administer and manage ECS is critical because of the potential impact on ECS operations and user support. Training on COTS hardware and software, and application software, regardless of the development track, is an absolute necessity. If the site's user services personnel are unable to handle issues about an ECS product, additional demands on developer's time will be made to isolate, remedy, or suggest work-arounds to the issues.

The facility access dates must be at least 2 months prior to the scheduled initial installation date to provide time for site verification inspection, completion Government facility preparations, and receiving of COTS HW and SW. Installations of HW and SW take between 2 and 6 weeks depending on whether the site is an initial installation (requiring LAN installation) and the quantity and complexity of the configurations to be installed.

After installation, staffing and training of the maintenance and operations (M&O) staff is accomplished. M&O training occurs during the 3-month system integration and acceptance testing window.

Another key objective is the ECS transition to Release B. The transition aspects of how this Release B site interoperates with the sites that are transitioning from A must be addressed. Reference the Transition to Release B Technical Paper (240-TP-010-001) for a more detailed discussion.

In addition to automated support, ECS subsystems provide the capability for the operations staff to perform a number of roles in support of these activities. These operational roles are identified in Table 3.1.2-1. The table identifies the corresponding SDPS or CSMS subsystem that enables the DAAC ECS operations staff to perform a particular role/function. Detailed descriptions of these activities are captured in the ECS Operations Concept for the ECS Project: Part 2B - ECS Release B (604-CD-002-003) document. The Release B SDPS/CSMS Operations Scenarios document (605-CD-002-001) provides additional detailed scenarios for these activities.

3.2 ORNL External Interfaces

ECS at the ORNL DAAC will interface with multiple entities external to the ECS subsystems. The ECS subsystem-specific DID305 design documents address the interfaces generically in a series of tables supported by textual explanations. For details, the reader is referred to those documents in addition to the various Interface Control Documents (ICDs). Figure 3.2-1 schematically illustrates the interfaces between the ECS subsystems at the ORNL DAAC and its external entities (sinks and sources of data). The figure enumerates data flows which are elaborated upon in Table 3.2-1.

Table 3.1.2-1. ORNL Operations Support Functions

ECS DAAC Operational Roles	Capability

User Services
  - Support user with data expertise
  - Generate and maintain data interface
	Data Management Subsystem

Data Ingest
  - Monitor electronic
  - Handle media
	Ingest Subsystem

Resource Planning	Systems Management Subsystem
Resource Management	Ingest & Data Server Subsystems in coordination with Systems Management Subsystem
Database Maintenance	Data Management Subsystem Data Server Subsystem Application specific (1)
System and Performance Analysis	Systems Management Subsystem
Security	Systems Management Subsystem
Accounting and Billing	Systems Management Subsystem
Sustaining Engineering	Office Support Systems Management Subsystem Communication Subsystem
S/W and H/W Maintenance	Office Support Systems Management Subsystem Communication Subsystem
Configuration Management (chg control)	Systems Management Subsystem
Testing, training, property management, integrated logistics support, library administration	Office Support Systems Management Subsystem Communication Subsystem

Notes:

1. Included to ensure that the number of small DBMSs throughout the system are not explicitly excluded (e.g., System Management Subsystem has a DBMS)

A description of the external entities follows:

- ORNL DAAC-Unique Archive - This interface is required for the ECS portion at the ORNL DAAC to access the data holdings archived at the ORNL DAAC-unique archive and distribution system. It also allows the ORNL ECS DAAC to import metadata and status information from ORNL DAAC-unique entities through ECS-provided API.

- Version 0 _ This interface to ORNL ECS DAAC supports access, using the Version 0 System IMS, to the V0 holdings that are not migrated to ECS. This interface is also used to support the V0 interoperability interface.

- SMC - This interface provides the capability for the ECS at ORNL DAAC to receive performance information, processing status, scheduling, and policy data and user
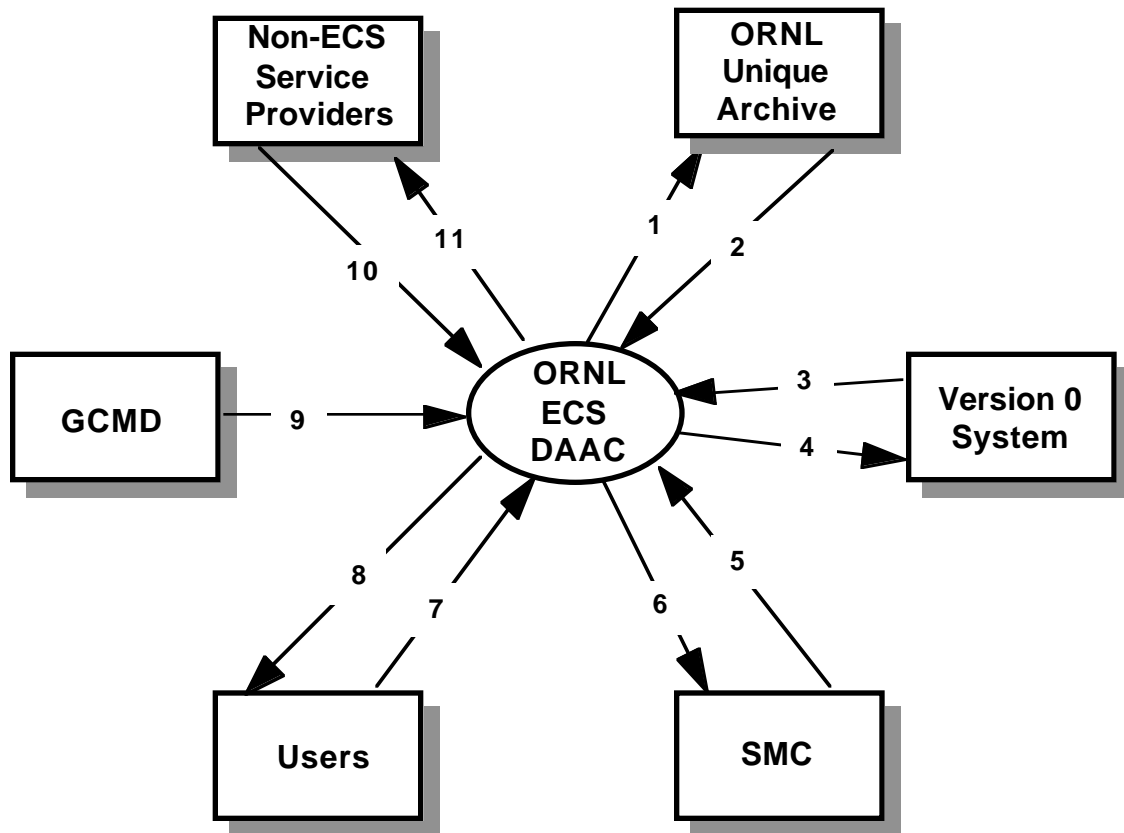
Figure 3.2-1. ORNL ECS DAAC External Interfaces

registration information. Policy data includes that established by the ESDIS project. The ECS subsystem at ORNL DAAC sends its system performance and status reports to SMC as part of this interface.

- Users - This interface is the mechanism for user community access to ECS data and services. It is the mechanism by which advertisements, user registration, order and product status, desktop object manipulations, and command languages capabilities are utilized.

- GCMD - The Global Change Master Directory (GCMD) is a multidisciplinary database of information about data holdings of potential interest to the scientific research community. It contains high level descriptions of data set holdings of various agencies and institutions. It also contains supplementary descriptions about these data centers, as well as scientific campaigns and projects, platforms, and sensors. This interface will allow the ECS at ORNL DAAC to import directory level information from the GCMD via GCMD export files and generate ECS data product advertisements.

- Non-ECS Service Providers - This interface is required for specialized users who use ECS data to provide and advertise value-added services. These providers include commercial, institution, or other government agencies, as well as IPs, SCFs, and ADCs.

305-CD-037-002

Table 3.2-1. ORNL External Interface (1 of 3)

Flow No.	Source	Destination	Data Types	Data Volume	Frequency
1	Data Server	ORNL Unique Archive	Data Requests	low	as requested
1	Data Server	ORNL Unique Archive	Metadata Query Results	low	as requested
1	Data Server	ORNL Unique Archive	Data Request Cancellation	low	as requested
2	ORNL Unique Archive	Ingest	Metadata	low	as required
2	ORNL Unique Archive	MSS	Order Status	low	as required
2	ORNL Unique Archive	Data Server	Metadata Query	low	as required
3	Version 0 System	Data Server	Inventory	low	as required
3	Version 0 System	Data Server	Guide	low	as required
3	Version 0 System	Data Server	Browse data	medium	as required
3	Version 0 System	Data Server	Dependent Valids	low	as required
3	Version 0 System	Data Management	V0 Directory search request	low	as requested
3	Version 0 System	Data Management	V0 Inventory search request	low	as requested
3	Version 0 System	Data Management	V0 browse request	low	as requested
3	Version 0 System	Data Management	V0 product order request	low	frequency dependent on user input
3	Version 0 System	Ingest	Migration Data	high	varies depending on migration strategy
4	Data Mgmt	Version 0 System	V0 Browse Result	low-medium	in response to ECS browse result
4	Data Mgmt	Version 0	V0 inventory result set	low-high	in response to ECS inventory result request
4	Data Mgmt	Version 0	V0 directory search result set	low-high	in response to ECS request
4	Data Mgmt	Version 0 System	V0 product order response	low	in response to product request result
4	Data Server	Version 0 System	Result Sets	medium-high	in response to request

Table 3.2-1. ORNL External Interfaces (2 of 3)

Flow No.	Source	Destination	Data Types	Data Volume	Frequency
4	Data Server	Version 0 System	Session Mgmt responses	low	in response to request
4	Data Server	Version 0 System	Product Request Status	low	as required
5	SMC	MSS	Policies	low	as required
5	SMC	MSS	Conflict Resolution	low	as required
5	SMC	MSS	Procedures	low	as required
5	SMC	MSS	Directives	low	as required
6	MSS	SMC	Conflict Resolution Request	low	as required
6	MSS	SMC	Status	low	as required
6	MSS	SMC	Performance	low	as required
7	Users	Client	User registration information	low	as requested
7	Users	Client	User login information	low	as requested
7	Users	Client	Search requests	low	as requested
7	Users	Client	Product requests	low	as requested
7	Users	Client	Acquisition requests	low	as requested
7	Users	Client	Desktop manipulate commands	low	as supplied by user
7	Users	Client	Configuration/Profile information	low	as supplied by user
7	Users	Client	Data manipulate requests	low	as requested
7	Users	Client	Command language request	low	as requested
7	Users	Client	Advertisements, Software, and Documents	low	as supplied by user
7	Users	Ingest	User Methods	medium	as required
7	Users	Ingest	Ingest Status Requests	low	as required
8	Data Server	Users	Metadata	low	as requested
8	Data Server	Users	Documents	low	as requested
8	Data Server	Users	Data Products	medium	as requested
8	Data Server	Users	Browse Products	medium	as required
8	Data Server	Users	Product Request Status	low	as requested
8	Data Server	Users	Schedules	low	as requested
8	Client	Users	Results Set	medium	as requested
8	Client	Users	Application user interfaces	low	as requested
8	Client	Users	Formatted data	medium	as requested
8	Client	Users	Desktop Objects	low	as requested

305-CD-037-002

Table 3.2-1. ORNL External Interfaces (3 of 3)

Flow No.	Source	Destination	Data Types	Data Volume	Frequency
8	Client	Users	Advertisement and Software	low	as requested
8	Client	Users	Error and Status information	low	as available
8	Ingest	Users	Ingest Status	low	as requested
9	GCMD	Interoperability	Advertisements	low-medium	as required
10	Non-ECS Service Providers	Interoperability	Advertisements	low-medium	as required
10	Non-ECS Service Providers	Interoperability	Subscriptions	low	as required
11	Interoperability	Non-ECS Service Providers	Notifications	low	in response to subscriptions

In the table, where an exact number is unavailable, the data volume is estimated as low (less than 1 MB), medium (between 1 MB and 1 GB), or high (greater than 1 GB) per use defined in the frequency column .

3.3 Computer Software Component Analysis

The ECS software subsystems are described in detail in the ECS Subsystem-specific DID 305 documents. This section provides a brief overview description of each of the subsystems, then as part of the analysis, addresses the CSCIs for each subsystem, focusing upon those CSCIs that are specific to the ECS at the ORNL DAAC. For the most part, the software is the same for all ECS DAACs. However, the content of databases and schema constructions may differ. In addition, the purchase of different OTS packages for the DAACs may be required.

3.3.1 Software Subsystem Overview

The 10 ECS software subsystems are described in detail in the ECS Subsystem-specific DID305 documents. This section provides a brief overview description of each of the subsystems.

Client Subsystem (CLS): This software consists of graphic user interface (GUI) programs, tools for viewing and/or manipulating the various kinds of ECS data (e.g., images, documents, tables) and libraries representing the client application program interface (API) of ECS services. The client subsystem consists of the desktop and the scientist workbench. The client subsystem components will be available to users for installation on their workstations and will also be deployed on workstations within the DAAC in support of normal operations, including User Services support.

Interoperability Subsystem (IOS): The interoperability subsystem is an advertising service. It maintains a database of information about the services and data offered by ECS, and allows users to search through this database to locate services and data that may be of

305-CD-037-002

interest to them. The advertising service will be implemented as a Web server application with a DBMS back-end.

Data Management Subsystem (DMS): This subsystem includes functions which provide uniform access to descriptions of the data and the data elements offered by the ECS repositories and provide a bi-directional gateway between ECS and Version 0. This subsystem also includes distributed search and retrieval functions and corresponding site interfaces.

Data Server Subsystem (DSS): The subsystem provides the physical storage access and management functions for the ECS earth science data repositories. Other subsystems can access it directly or via the data management subsystem (if they need assistance with searches across several of these repositories). The subsystem also includes the capabilities needed to distribute bulk data via electronic file transfer or physical media. Other components include, for example, administrative software to manage the subsystem resources and perform data administration functions (e.g., to maintain the database schema); and data distribution software, e.g., for media handling and format conversions. The main components of the subsystem are the following:

- database management system - uses an off-the-shelf DBMS (Illustra) to manage its earth science data and implement spatial searching, as well as for the more traditional types of data (e.g., system administrative and operational data). It will use a document management system to provide storage and information retrieval for guide documents, scientific articles, and other types of document data.

- file storage management systems - used to provide archival and staging storage for large volumes of data. Provides hierarchical storage support and device/media independence to the remainder of DSS and ECS. This component of the subsystem is not part of the ECS delivery at ORNL.

- data type libraries - they will implement functionality of earth science and related data that is unique and not available off the shelf (e.g., spatial search algorithms and translations among coordinate systems). The libraries will interface with the data storage facilities, i.e., the database and file storage management systems.

Ingest Subsystem (INS): The subsystem deals with the initial reception of all data received at an ECS facility and triggers subsequent archiving and processing of the data. Given the variety of possible data formats and structures, each external interface, and each ad-hoc ingest task may have unique aspects. Therefore, the ingest subsystem is organized into a collection of software components (e.g., ingest management software, translation tools, media handling software) from which those required in a specific situation can be readily configured. The resultant configuration is called an ingest client. Ingest clients can operate on a continuous basis to serve a routine external interface; or they may exist only for the duration of a specific ad-hoc ingest task.

Data Processing Subsystem (DPS): The main components of the data processing subsystem - the science software - will be provided by the science teams. The data processing subsystem will provide the necessary hardware resources, as well as software

for queuing, dispatching and managing the execution of the science software in an environment which eventually will be highly distributed and consist of heterogeneous computing platforms. The DPS also interacts with the DSS to cause the staging and de-staging of data resources in synchronization with processing requirements. Note that this subsystem will not be a part of ECS delivery at ORNL.

Planning Subsystem (PLS): This subsystem provides the functions needed to pre-plan routine data processing, schedule on-demand processing, and dispatch and manage processing requests. The subsystem provides access to the data production schedules at each site, and provides management functions for handling deviations from the schedule to operations and science users. Note that this subsystem will not be a part of ECS delivery at ORNL.

System Management Subsystem (MSS): The Management Subsystem (MSS) provides enterprise management (network, system and application management) for all ECS resources: commercial hardware (including computers, peripherals, and network routing devices), commercial software, and custom applications. Enterprise management reduces overall development and equipment costs, improves operational robustness, and promotes compatibility with evolving industry and government standards. Consistent with current trends in industry, the MSS thus manages both ECS's network resources per EBnet requirements and ECS's host/application resources per SMC requirements. Additionally MSS also supports many requirements allocated to SDPS and FOS for management data collection and analysis/distribution.

The MSS allocates services to both the system-wide and local levels. With few exceptions, the management services will be fully decentralized, no single point of failure exists which would preclude user access. In principle every service is distributed unless there is an overriding reason for it to be centralized. MSS has two key specializations: Enterprise Monitoring and Coordination Services and Local System Management Services.

Communications Subsystem (CSS): The CSS services include Object Services, Distributed Object Framework (DOF) and Common Facility Services. Support in this subsystem area is provided for peer-to-peer, advanced distributed, messaging, management, and event-handling communications facilities. These services typically appear on communicating end-systems across an internetwork and are not layered, but hierarchical in nature. Additionally, services to support communicating entities are provided, including directory, security, time, and other ancillary services. The services of the Communications Subsystem are functionally dependent on the services of the Internetworking Subsystem. The services of the common facility, object and DOF are the fundamental set of interfaces for all management and user access (i.e., pull) domain services. The DOF services are the fundamental set of dependencies of the common facility and object services.

Internetworking Subsystem (ISS): The Internetworking Subsystem provides for the transfer of data transparently within the DAACs, SMC and EOC, and for providing interfaces between these components and external networks. ECS interfaces with external systems and DAAC to DAAC communications are provided by the EOSDIS Backbone network (EBnet). EBnet's primary function is to transfer data between DAACs, including both

product data and inter-DAAC queries and metadata responses. Other networks, such as NSI, will provide wide-area services to ECS. In addition, "Campus" networks, which form the existing networking infrastructure at the ECS locations, will provide connectivity to EOSDIS components such as SCFs and ISTs.

3.3.2 Software Subsystem Analysis Summary

The subsystems that comprise SDPS and CSMS have already been described in detail in companion CDR documents. This section addresses the CSCIs from each subsystem and identifies their ORNL ECS DAAC specifics. Generally, the software is the same for all ECS DAACs. The content of databases and schema constructions may differ. In the case of OTS packages the possibility arises for the purchase of different versions for different DAAC hardware but even this will be extremely minimal for Release B. In this section, each of the subsystems will be addressed in a somewhat general manner to point out whether or not there are any ORNL DAAC specific portions.

- Client Subsystem - The client software will not have any ORNL ECS DAAC specific portions except for the possibility of different versions of OTS packages due to different types of hardware. Since the services offered by the client are required by operations, user services, and systems administrators, the ORNL ECS DAAC will have clients installed on several different ECS furnished workstations. In addition the ORNL V0 DAAC may desire the client on some of their existing workstations to provide additional user access.

- Data Server - This subsystem will have certain portions that may be specific to the ORNL ECS DAAC due to the ORNL ECS DAAC data collections. The software components of the Data Server Subsystem are largely the same for all Data Servers, at all DAACs. The two basic areas in which the Data Server Subsystem software will vary from the DAAC to DAAC are configuration and special components.

  Data Server software is designed to be highly configurable in order to allow a wide variety of DAAC unique policy implementations. These unique configurations will enable the data server software installations to vary behavior, meeting the DAAC specific needs. Examples of configuration parameters include number of concurrent connections, number of requests per client, inactivity timeout period and allocation of software components to hardware.

  Another facet of the Data Server Subsystem software that supports the specific DAAC capabilities is in the actual components that are installed at the ECS portion of the DAAC. These opportunities for the DAAC specificity are driven by the types of distribution available to the DAACs data server clients and in the types of data (and the data type services) available.

- Data Management - None of the data management software will be unique to the ORNL ECS DAAC. The V0 Gateway (GTWAY) will interface with the data servers at each site. Local and cross-DAAC searches on V0 DAACs' data holdings (not currently migrated) are provided via capabilities resulting from integrating the components from the V0 System IMS into ECS.

- Ingest - The software portions for ingest at the ORNL ECS DAAC may differ from those of other ECS DAACs because of dataset dependencies and differences related to non-homogeneous computer hardware across the Release B DAACs. Data ingestion procedures must match the peculiarities of the ingested data sets. Several types of ingest clients are described in the Ingest Subsystem companion document.

- Interoperability - There are no ORNL ECS DAAC specific portions of the Interoperability Subsystem .

- Production Planning - This subsystem is not part of ORNL ECS DAAC delivery.

- Data Processing - This subsystem is not part of ORNL ECS DAAC delivery.

- Communications Subsystem - There are no ORNL ECS DAAC specific portions of this subsystem.

- Systems Management - This subsystem is composed of a variety of management applications, providing services such as fault, performance, security and accountability management for ECS networks, hosts, and applications. Two tiers of "view" (domain of management service interface) provided by the applications in this subsystem. Only the local management view is provided at the ORNL ECS DAAC. There are no ORNL ECS DAAC specific portions of this subsystem.

- Internetworking Subsystem - There are no ORNL ECS DAAC specific software portions of this subsystem.

Table 3.3.2-1 lists the ECS subsystems and associated CSCIs and CSCs. For each CSC, there is an indication of the type of component. As defined in the DID 305 subsystem-specific documents, type indicates whether the component is custom developed (DEV), off the shelf (OTS), a CSC reused from another subsystem (reuse), a wrapper (WRP) that encapsulates OTS, or a combination of these types. The Use column indicates whether a generic-for-all-DAACs (Gnrc) form of the CSC is implemented or specific (Spfc) tailoring or use is required at a DAAC. The Notes column is included to comment about the characteristics of the system, data, and/or software that makes the CSC specific, as well as to provide any additional information about the generic CSCs. The OTS products are also listed in this column.

Table 3.3.2-1. ORNL DAAC Components Analysis (1 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Client	DESKT	Desktop Manager	DEV	Gnrc	
Client	WKBCH	Comment/Survey Tool	OTS/ DEV	Gnrc	WWW Browser
Client	WKBCH	Data Acquisition Request Tool	DEV	Gnrc	
Client	WKBCH	Data Dictionary Tool	DEV	Gnrc	
Client	WKBCH	Document Search Tool	OTS	Reuse	CSS-provided

Table 3.3.2-1. ORNL DAAC Components Analysis (2 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Client	WKBCH	Earth Science Search Tool	DEV	Gnrc	
Client	WKBCH	E-mailer Tool	OTS	Reuse	CSS-provided
Client	WKBCH	Hypertext Authoring Tool	OTS	Gnrc	MS Office / TBD public domain
Client	WKBCH	Hypertext Viewer	OTS	Gnrc	WWW Browser
Client	WKBCH	Logger/Reviewer Tool	DEV	Gnrc	
Client	WKBCH	News Reader Tool	OTS	Reuse	CSS-provided
Client	WKBCH	Product Request Tool	DEV	Gnrc	
Client	WKBCH	Session Management Tool	DEV	Gnrc	
Client	WKBCH	User Preferences Tool	DEV	Gnrc	
Client	WKBCH	User Registration Tool	DEV	Gnrc	
Client	WKBCH	Visualization Tool	DEV	Gnrc	
Communication	DCCI	Bulletin Board	OTS	Reuse	CSS-provided
Communication	DCCI	Directory/Naming Services	OTS/ DEV	Gnrc	OODCE
Communication	DCCI	Distributed File System (DFS)	OTS	Gnrc	DCE
Communication	DCCI	DOF Services	OTS	Gnrc	OODCE
Communication	DCCI	Electronic Mail Services	OTS/ DEV	Gnrc	native operating system
Communication	DCCI	Event Logger Services	OTS/ DEV	Gnrc	DCE
Communication	DCCI	File Access Services	OTS/ DEV	Gnrc	ftp, kftp, DCE
Communication	DCCI	Life Cycle Services	OTS/ DEV	Gnrc	OODCE
Communication	DCCI	Message Passing Services	OTS/ DEV	Gnrc	Developed with OODCE
Communication	DCCI	Security Services	OTS/ DEV	Gnrc	OODCE
Communication	DCCI	Thread Services	OTS	Gnrc	OODCE
Communication	DCCI	Time Services	OTS/ DEV	Gnrc	OODCE
Communication	DCCI	Virtual Terminal Services	OTS	Gnrc	native operating system

Table 3.3.2-1. ORNL DAAC Components Analysis (3 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Data Management	DDICT	Client Library	DEV	Gnrc	
Data Management	DDICT	Configuration/Setup	DEV	Gnrc	
Data Management	DDICT	DBMS Server	OTS	Gnrc	Sybase DBMS
Data Management	DDICT	Maintenance Tool	DEV	Gnrc	
Data Management	DDICT	Persistent Data	DEV	Gnrc	
Data Management	DDICT	Request Processing	DEV	Gnrc	
Data Management	DDICT	Server	DEV	Gnrc	
Data Management	DIMGR	Configuration/Setup	DEV	Gnrc	
Data Management	DIMGR	Server	DEV	Gnrc	
Data Management	GTWAY	Configuration/Setup	DEV	Gnrc	
Data Management	GTWAY	Server	DEV	Gnrc	
Data Management	GTWAY	V0 Back End	OTS	Gnrc	From V0
Data Management	GTWAY	V0 Client Interface	DEV	Gnrc	
Data Management	GTWAY	V0 External Interface	DEV	Gnrc	
Data Management	GTWAY	V0 Front End	OTS	Gnrc	From V0
Data Management	LIMGR	Client Library	DEV	Gnrc	
Data Management	LIMGR	Configuration/Setup	DEV	Gnrc	
Data Management	LIMGR	Database Interface	OTS	Gnrc	RogueWave DBTools
Data Management	LIMGR	External Interface	DEV	Gnrc	
Data Management	LIMGR	Mapping Layer	DEV	Gnrc	
Data Management	LIMGR	Request Processing	DEV	Gnrc	
Data Management	LIMGR	Server	DEV	Gnrc	

Table 3.3.2-1. ORNL DAAC Components Analysis (4 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Data Server	DDSRV	DDSRV	DEV/ OTS	Gnrc	RogueWave class libraries
Data Server	DDSRV	DDSRV Client	DEV/ OTS	Gnrc	OODCE; RogueWave class libraries
Data Server	DDSRV	DDSRV CSDT	DEV/ OTS	Gnrc	RogueWave class libraries
Data Server	DDSRV	DDSRV ESDT	DEV/ OTS/ Reuse	Gnrc	Reuse from SDSRV; RogueWave class libraries
Data Server	DDSRV	DDSRV Search Engine	DEV/ OTS	Gnrc	Topic and Netscape server
Data Server	DDSRV	DDSRV Server	DEV	Gnrc	Topic API; RogueWave class libraries
Data Server	DDSRV	Gateway	DEV/ OTS	Gnrc	Netscape libraries
Data Server	SDSRV	Administration and Operations	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	Client	DEV/ OTS	Gnrc	OODCE; RogueWave class libraries
Data Server	SDSRV	Configuration and Startup	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	CSDT	DEV OTS	Gnrc	HDF-EOS
Data Server	SDSRV	DB Wrappers	DEV OTS	Gnrc	Illustra DBMS server and API
Data Server	SDSRV	Descriptors	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	General ESDT	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	Global	DEV/ OTS	Gnrc	RogueWave class libraries
Data Server	SDSRV	GUI	DEV OTS	Gnrc	RogueWave class libraries; X-11/Motif
Data Server	SDSRV	Metadata	DEV/ Wrpr	Gnrc	Illustra DBMS API
Data Server	SDSRV	Non-Product Science ESDT	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	Non-Science ESDT	DEV	Gnrc	RogueWave class libraries
Data Server	SDSRV	Server	DEV/ OTS	Gnrc	RogueWave class libraries
Data Server	SDSRV	Subscriptions	DEV/ OTS	Gnrc	RogueWave class libraries
Ingest	INGST	Ingest Administration Data	DEV	Gnrc	

305-CD-037-002

Table 3.3.2-1. ORNL DAAC Components Analysis (5 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Ingest	INGST	Ingest Data Preprocessing	DEV	Spfc	Specific based on uniqueness of ingested data and preprocessing requirements.
Ingest	INGST	Ingest Data Transfer	DEV	Gnrc	
Ingest	INGST	Ingest DBMS	OTS	Gnrc	Sybase DBMS
Ingest	INGST	Ingest Request Processing	DEV	Gnrc	
Ingest	INGST	Ingest Session Manager	DEV	Gnrc	
Ingest	INGST	Operator Ingest Interfaces	DEV	Gnrc	
Ingest	INGST	Polling Ingest Client Interface	DEV	Gnrc	
Ingest	INGST	User Network Ingest Interface	DEV	Gnrc	
Ingest	INGST	Viewing Tools	Reuse	Gnrc	Reused from Client subsystem, WKBCH CSCI, Data Visualization (EOSView) CSC
Interoperability	ADSRV	AdvNavigationServer	OTS	Gnrc	HTTP server
Interoperability	ADSRV	Client Library	DEV	Gnrc	
Interoperability	ADSRV	Core Library	DEV	Gnrc	
Interoperability	ADSRV	HTML Framework	DEV	Gnrc	
Interoperability	ADSRV	HTML Interfaces	DEV	Gnrc	
Interoperability	ADSRV	Installer	DEV	Gnrc	
Interoperability	ADSRV	Persistent Object Framework	DEV	Gnrc	
Internetworking	INCI	Datalink/Physical	OTS	Gnrc	firmware, vendor-supplied with hardware
Management	MACI	Application MIB	DEV	Gnrc	
Management	MACI	ECS Subagent	DEV	Gnrc	
Management	MACI	Encapsulator for non-Peer Agent	OTS/ DEV	Gnrc	OptiMate
Management	MACI	Extensible SNMP Master Agent	OTS/ DEV	Gnrc	Peer Network's agent, along with its toolkit for Dev
Management	MACI	Instrumentation Class Library	DEV	Gnrc	
Management	MACI	Management Agent Services	OTS/ DEV	Gnrc	Peer and Tivoli/Sentry
Management	MACI	Proxy Agent	DEV	Gnrc	

305-CD-037-002

Table 3.3.2-1. ORNL DAAC Components Analysis (6 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Management	MACI	SNMP Manager's Deputy	DEV	Gnrc	
Management	MCI	Accountability	DEV	Gnrc	
Management	MCI	Application Management	DEV	Gnrc	
Management	MCI	Automatic Actions	DEV	Gnrc	
Management	MCI	Billing and Accounting Management	OTS/ DEV	Gnrc	ITS selection in progress
Management	MCI	DCE Cell Management	OTS	Gnrc	HP Account Manager Toolr
Management	MCI	Diagnostic Tests	OTS	Gnrc	vendor-supplied with hardware
Management	MCI	Fault Management	OTS/ DEV	Gnrc	Tivoli and HP OpenView
Management	MCI	Management Data Access	DEV	Gnrc	
Management	MCI	Management Data Access User Interface	DEV	Gnrc	
Management	MCI	Management Framework	OTS	Gnrc	HP OpenView Network Node Manager
Management	MCI	Management Proxy	DEV	Gnrc	
Management	MCI	Mode Management	DEV	Gnrc	
Management	MCI	Network Manager	OTS	Gnrc	HP OpenView Network Node Manager
Management	MCI	Performance Management	OTS/ DEV	Gnrc	RFP released
Management	MCI	Performance Management Proxy	DEV	Gnrc	
Management	MCI	Performance Test	OTS	Gnrc	vendor-supplied with hardware
Management	MCI	Physical Configuration Management	OTS	Gnrc	Mountain View
Management	MCI	Physical Configuration Proxy Agent	DEV	Gnrc	
Management	MCI	Report Generation	OTS	Gnrc	No decision yet, evaluation in progress
Management	MCI	Report Generation and Distribution	DEV	Gnrc	
Management	MCI	Report Generation Manager	DEV	Gnrc	

305-CD-037-002

Table 3.3.2-1. ORNL DAAC Components Analysis (7 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Management	MCI	Resource Class Category	DEV	Gnrc	
Management	MCI	Security Databases	OTS	Gnrc	Operating System Password Files, DCE Registry Database, Router Configuration Files, TCP Wrappers configuration files, Operating System Access Control Lists, DCE Access Control Lists
Management	MCI	Security Management	DEV	Gnrc	
Management	MCI	Security Management Proxy	DEV	Gnrc	
Management	MCI	Security Tests	OTS	Gnrc	CRACK, COPS, SATAN, TRIPWIRE
Management	MCI	Trouble Ticketing Management Service	OTS	Gnrc	Remedy Action Request System
Management	MCI	Trouble Ticketing Proxy Agent	DEV	Gnrc	
Management	MCI	Trouble Ticketing Service Requester	DEV	Gnrc	
Management	MCI	Trouble Ticketing User Interface	DEV	Gnrc	
Management	MCI	User Contact Tool	OTS/ DEV	Gnrc	Remedy
Management	MCI	User Profile Server	DEV	Gnrc	
Management	MLCI	Baseline Manager	OTS/ DEV	Gnrc	XRP II
Management	MLCI	Configuration Management	OTS	Gnrc	ClearCase
Management	MLCI	Inventory/Logistics/ Maintenance (ILM) Manager	OTS/ DEV	Gnrc	Vendor evaluation in progress
Management	MLCI	Policies and Procedures Management	DEV	Gnrc	
Management	MLCI	Software Change Manager	OTS/ DEV	Gnrc	ClearCase
Management	MLCI	Software Distribution Management Structure	OTS/ DEV	Gnrc	ClearCase and Tivoli

305-CD-037-002

Table 3.3.2-1. ORNL DAAC Components Analysis (8 of 8)

Subsystem	CSCI	CSC	Type	Use	Notes
Management	MLCI	Software Request Manager	OTS/ DEV	Gnrc	DDTS
Management	MLCI	Training Management	DEV	Gnrc	

3.4 DAAC Hardware and Network Design

This section describes the ECS hardware and local area network design supporting the Release B ECS mission at the ORNL DAAC. Section 3.4.1 contains an overview diagram from the "networks" point of view, and detailed descriptions of the Release B LANs. Section 3.4.2 contains a hardware overview diagram of all of the ECS subsystems at ORNL, followed by detailed descriptions and rationale for each subsystem.

3.4.1 ORNL DAAC LAN Configuration

The ECS ORNL DAAC is a new facility for Release B. It is a unique DAAC in that ECS provides only IMS functionality. ECS will store ORNL metadata and allow access to the metadata by users. ECS will also accept requests for data and processing, but will pass these requests on to ORNL, who will satisfy the requests and distribute the data directly to the users without involving ECS. ECS will also provide ORNL DAAC browse data in response to user requests. Thus, only CSS/MSS hosts, Data Management hosts, and a subset of Data Server hosts will be present.

ECS will receive metadata from ORNL intermittently and fairly infrequently. The number of metadata transfers per year is estimated at 25,000. This amounts to a data volume of approximately 50 megabytes per year. In addition, the V0 migration adds approximately 350,000 metadata transfers over a three year period, which amounts to a data volume of approximately 140 megabytes per year. These volumes create only minor network data flows.

Another flow to ECS is from users accessing the metadata and performing user request services that generate only moderate amounts of traffic. This data volume is estimated at less than 2 megabits per second. Requests for data are filled by ORNL and the associated data flows do not utilize the ECS network.

A third user flow involves users requesting browse data from the ORNL DAAC archive. The traffic estimate for browsing was provided by the ORNL DAAC as approximately 3 megabits per second.

The ORNL host from which ECS will receive metadata and browse data and to which user orders will be sent is connected to an FDDI ring internal to ORNL's network but accessible to ECS through the ORNL External FDDI ring.

The ECS ORNL DAAC LAN design consists of a pair of FDDI ring segments connected to the ECS switch/router. The switch/router is connected via FDDI to the ORNL (GFE) Gateway Router on ORNL's External FDDI ring to provide ECS with access to the Internet via ESnet as well as

access to ORNL's metadata host. The creation of separate User and Processing networks allows ingest and processing flows to be unaffected by user pull demands. This topology is depicted in Figure 3.4.1-1.
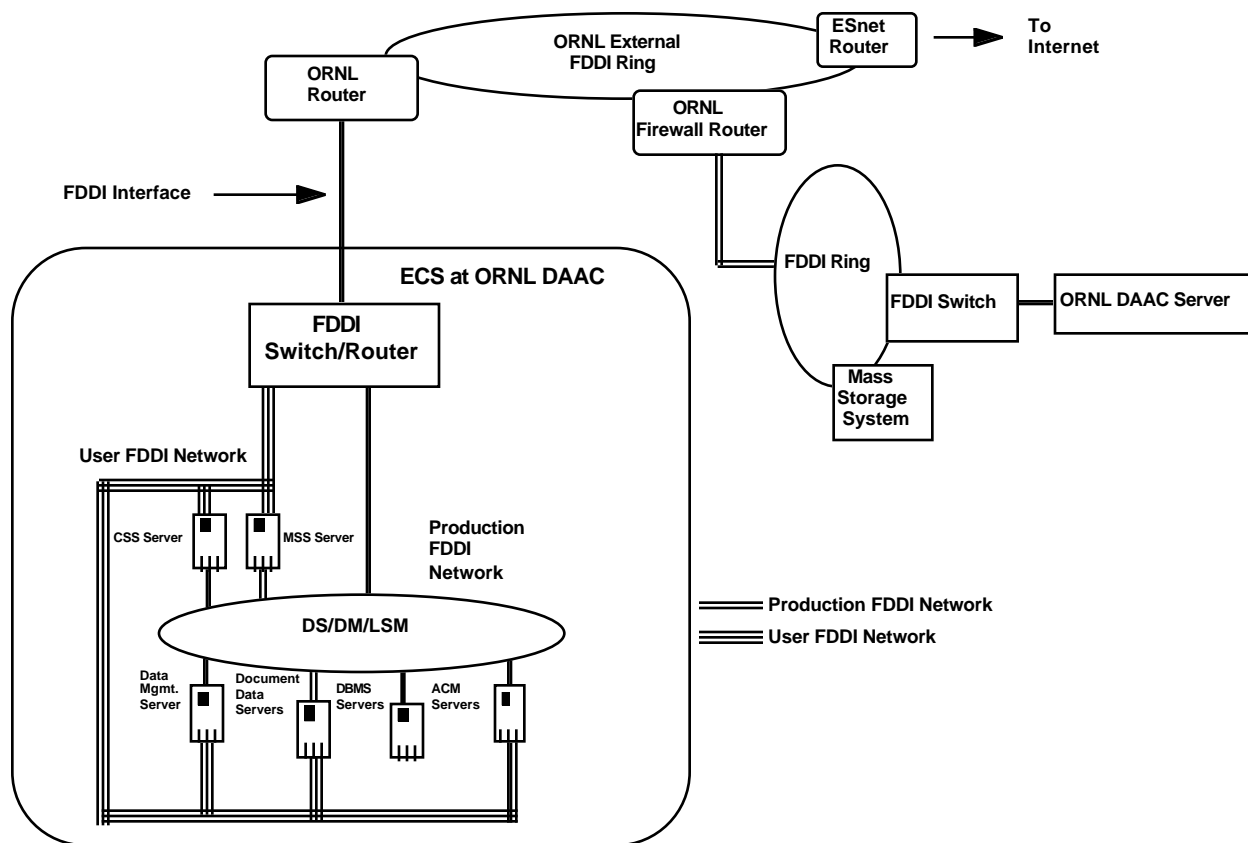
Figure 3.4.1-1. ORNL DAAC LAN Topology

The topology consists of a User FDDI Network and a Production FDDI Network. (The label "Production Network" is not to imply product creation at ORNL, rather, to maintain consistency of LAN design terminology across the ECS DAACs.) The User Network is an FDDI-based LAN connecting the users (via ESnet) to DAAC hosts responsible for providing user access. It has the main advantage of separating user and metadata ingest/production flows. This allows DAAC processing data flows to be unaffected by user demand. Basically, the User Network provides access to Data Manager hosts and to a subset of Data Server hosts that interact directly with users; users will not have access to any other ECS hosts. The CSS and MSS servers are connected to the User Network but will not allow direct user access. These connections are required for communications the other ECS DAACs and outside networks for such things as name lookups and receipt of Internet mail, as well as communication with and monitoring of the DAAC's interfaces to the user community (such as ESnet).

The User Network will connect, via FDDI, to ESnet through an ORNL router which will provide the necessary routing and filtering controls. This router is connected to ORNL's FDDI-based external FDDI ring. ESnet will be the sole Internet provider for ECS at ORNL.

The ECS Production Network is also connected to the ECS switch/router to provide access to the ORNL DAAC for metadata and browse data and product requests.

Individual FDDI rings for the Production and User Networks will be implemented with FDDI concentrators to provide ease of wiring and central points of management. All Production Network DAAC hosts will have FDDI interfaces and will be attached directly to the FDDI rings. Workstations will have single-attached FDDI cards, whereas high-performance servers on the Production Network will have dual-attached FDDI cards to provide redundancy. Dual-attached hosts will be dual-homed to two separate FDDI concentrators to provide an additional level of redundancy in the event of a hub failure. Interfaces of User Network hosts will be single-attached except for the Data Management Server, which will be dual-attached. Printers, which will be the only Ethernet devices in the ORNL ECS DAAC, will be connected to the DS/DM/LSM FDDI ring via an FDDI-to-Ethernet hub.

Required quantities of networking hardware components for the ORNL ECS DAAC during Release B are presented in Table 3.4.1-1.

Table 3.4.1-1. Release B Networking Hardware for ORNL DAAC LAN

Networking Component	Quantity	Comments
FDDI Concentrator	5	Bay Networks 2914-04 concentrator with 12 M & 1 A/B port
FDDI Switch/Router	1	Interconnects ECS network to ORNL Exchange LAN
FDDI Cables	48	Multimode fiber cables with MIC connectors
FDDI-to-Ethernet Hub	1	Cabletron MicroMMAC-22E; used for printers
Ethernet Cables	1	10baseT connection to printer

3.4.1.1 Sizing/Performance Rationale

The data flow estimates used as input to the design process for the ORNL DAAC LAN topology are contained in Table 3.4.1.1-1. The table, based on metadata volumes and user browse volumes provided by ORNL DAAC and the February 1996 User Pull Baseline (results for the greater of July 1999 and January 2000) for NSIDC to approximate the ORNL user pull data volume, is arranged according to the source and sink of the flow. It provides both raw 24-hour average data flows which are the output of ECS models, as well as weighted flows containing all overhead and contingency factors. The "Factors Applied" column shows which of the factors (listed beneath the table) were applied to each data flow.

305-CD-037-002

Table 3.4.1.1-1. Estimated Release B Data Flows for the ORNL DAAC

Major Data Flow Description *	Raw Volume (in Mbps)	Factors Applied	Weighted Volume (in Mbps)
ACM Server from ORNL Metadata Archive	<<0.1	1,2,3,4,5,6	<<0.1
ACM Server to/from other DAACs	<< 0.1	1,2,3,4,5,6	<< 0.1
User Pull	4.4	2,3,4,5,6	12.4

*Other flows such as session establishments amongst the subsystem hosts and subsystems to and from MSS are trace amounts and are not included in the table.

Overhead Factors:

(1) SSI&T Factor: 1.2. This factor not applied to User flows. Accounts for capacity for integration and test flows.

(2) TCP/IP/FDDI Protocol Overhead: 1.25. Accounts for overhead associated with FDDI, IP, TCP, and other protocols (such as DCE).

(3) FDDI Maximum Circuit Utilization Factor: 1.25. Accounts for amount of 100 Mbps bandwidth that is actually usable for sustained data rates.

(4) Average-to-peak Conversion Factor: 1.5. This provides elasticity in the network by converting the 24 hour averages provided by the model into peaks.

(5) Scheduling Contingency: 1.2. This reflects the ability for the network to recover within 24 hours from a 4 hour down-time (24/20=1.2).

(6) Operational Hours Factor: 1.0 at ORNL . Accounts for percentage of day/week operations are performed. This factor is applied only to production flows, not to user flows.

3.4.2 DAAC Hardware Configuration

The ECS DAAC hardware suite at ORNL hosts the Data Server, Data Management, Ingest, Interoperability, Management and Communications subsystems. The hardware and COTS software selected for the ORNL configuration is illustrated in Figure 3.4.2-1, ORNL ECS DAAC Hardware Configuration Diagram. These configurations represent the candidate hardware selections which most closely satisfy the processing, storage capacities and communications bandwidth requirements described in the following sections. In some cases the selected configuration appears to significantly exceed the requirements due to the sizing increments provided by the selected vendor, when in reality, our analysis and selection process has provided cost effective solutions to each problem.

3.4.2.1 Client Subsystem

There is no dedicated hardware support (HWCI) for the Client Subsystem. The Client software configurations are supported by: (1) non-ECS provided hardware platforms, in the case of Client software utilized by the user community, or (2) ECS provided workstations utilizing Client software in support of operations users (network management, DAAC operations, etc.).
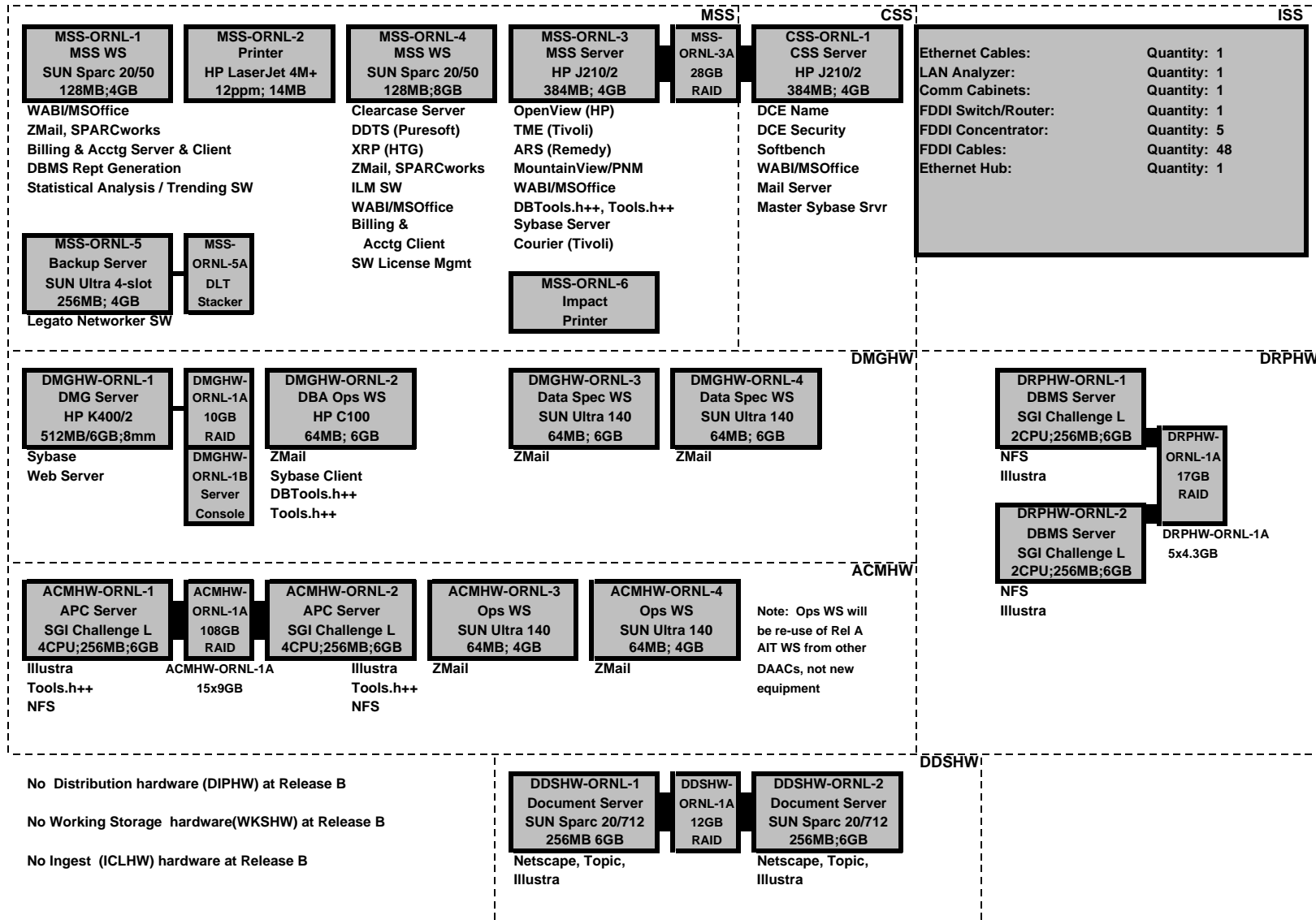
ORNL at Rel B

Note: All systems come with OS, C, C++, DCE, OODCE, Clearcase agent, SNMP agent (Optima), Sybase client, Tivoli client, CD-ROM, FDDI. RAID quantities are USABLE.

No DPS (SPRHW, AITHW, AQAHW) at Release B

No INS (ICLHW) at Release B

No PLS (PLNHW) at Release B

MSS | CSS | ISS

| MSS-ORNL-1 MSS WS SUN Sparc 20/50 128MB;4GB | MSS-ORNL-2 Printer HP LaserJet 4M+ 12ppm; 14MB | MSS-ORNL-4 MSS WS SUN Sparc 20/50 128MB;8GB | MSS-ORNL-3 MSS Server HP J210/2 384MB; 4GB | MSS-ORNL-3A 28GB RAID | CSS-ORNL-1 CSS Server HP J210/2 384MB; 4GB |

MSS-ORNL-1:
WABI/MSOffice
ZMail, SPARCworks
Billing & Acctg Server & Client
DBMS Rept Generation
Statistical Analysis / Trending SW

MSS-ORNL-4:
Clearcase Server
DDTS (Puresoft)
XRP (HTG)
ZMail, SPARCworks
ILM SW
WABI/MSOffice
Billing &
 Acctg Client
SW License Mgmt

MSS-ORNL-3:
OpenView (HP)
TME (Tivoli)
ARS (Remedy)
MountainView/PNM
WABI/MSOffice
DBTools.h++, Tools.h++
Sybase Server
Courier (Tivoli)

CSS-ORNL-1:
DCE Name
DCE Security
Softbench
WABI/MSOffice
Mail Server
Master Sybase Srvr

ISS:
Ethernet Cables:	Quantity: 1
LAN Analyzer:	Quantity: 1
Comm Cabinets:	Quantity: 1
FDDI Switch/Router:	Quantity: 1
FDDI Concentrator:	Quantity: 5
FDDI Cables:	Quantity: 48
Ethernet Hub:	Quantity: 1

| MSS-ORNL-5 Backup Server SUN Ultra 4-slot 256MB; 4GB | MSS-ORNL-5A DLT Stacker |

Legato Networker SW

| MSS-ORNL-6 Impact Printer |

DMGHW | DRPHW

| DMGHW-ORNL-1 DMG Server HP K400/2 512MB/6GB;8mm | DMGHW-ORNL-1A 10GB RAID | DMGHW-ORNL-2 DBA Ops WS HP C100 64MB; 6GB | DMGHW-ORNL-3 Data Spec WS SUN Ultra 140 64MB; 6GB | DMGHW-ORNL-4 Data Spec WS SUN Ultra 140 64MB; 6GB |

DMGHW-ORNL-1:
Sybase
Web Server

DMGHW-ORNL-1B Server Console

DMGHW-ORNL-2:
ZMail
Sybase Client
DBTools.h++
Tools.h++

DMGHW-ORNL-3: ZMail

DMGHW-ORNL-4: ZMail

| DRPHW-ORNL-1 DBMS Server SGI Challenge L 2CPU;256MB;6GB | DRPHW-ORNL-1A 17GB RAID |

DRPHW-ORNL-1:
NFS
Illustra

| DRPHW-ORNL-2 DBMS Server SGI Challenge L 2CPU;256MB;6GB |

DRPHW-ORNL-1A 5x4.3GB

DRPHW-ORNL-2:
NFS
Illustra

ACMHW

| ACMHW-ORNL-1 APC Server SGI Challenge L 4CPU;256MB;6GB | ACMHW-ORNL-1A 108GB RAID | ACMHW-ORNL-2 APC Server SGI Challenge L 4CPU;256MB;6GB | ACMHW-ORNL-3 Ops WS SUN Ultra 140 64MB; 4GB | ACMHW-ORNL-4 Ops WS SUN Ultra 140 64MB; 4GB |

ACMHW-ORNL-1:
Illustra
Tools.h++
NFS

ACMHW-ORNL-1A 15x9GB

ACMHW-ORNL-2:
Illustra
Tools.h++
NFS

ACMHW-ORNL-3: ZMail

ACMHW-ORNL-4: ZMail

Note: Ops WS will be re-use of Rel A AIT WS from other DAACs, not new equipment

DDSHW

No Distribution hardware (DIPHW) at Release B

No Working Storage hardware(WKSHW) at Release B

No Ingest (ICLHW) hardware at Release B

| DDSHW-ORNL-1 Document Server SUN Sparc 20/712 256MB 6GB | DDSHW-ORNL-1A 12GB RAID | DDSHW-ORNL-2 Document Server SUN Sparc 20/712 256MB;6GB |

DDSHW-ORNL-1:
Netscape, Topic, Illustra

DDSHW-ORNL-2:
Netscape, Topic, Illustra

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3.4.2.2 Data Server Subsystem

During the Release B time frame at the ORNL DAAC, a Data Server configuration is supplied to support advertising and integration of the ORNL data sets and services to the ECS distributed system. The configuration discussed in the subsections that follow provides a snapshot view of the configuration and sizing of the Data Server hardware for Release B.

The Data Server Subsystem hardware configuration provided at ORNL is supported by three hardware CIs and is sized for the mission support as described above for a period of one calendar year beyond AM-1 launch date:

- *Access Control & Management (ACMHW HWCI)* -- The access hardware allows for client access (both the client subsystem and direct user access to the Data Base and Browse Data) to the Data Server subsystem, provides tools and capabilities for system administration, and is broken down into two components; Administration Stations (AS), which consist of operations support workstations, and Access/Process Coordinators (APCs), which consist of server class machines with host attached storage.

- *Data Repository (DRPHW HWCI)* -- Data Repositories (DRs) are the hardware components that store and maintain data permanently. Since the ORNL DAAC maintains its archives via the campus Unitree archive system, this HWCI consists simply of the DBMS repositories.

- *Document Data Server (DDSHW HWCI)* -- This HWCI provides the disk and server required to support the Document Data Server portion of the DSS.

3.4.2.2.1 Rationale

The following subsystem-wide assumptions were applied in sizing the Data Server hardware components. Data Server Subsystem is sized for supporting the data base storage and user session loads for a period of one calendar year beyond AM-1 launch date. The ECS technical baseline for February 1996 was used in dynamic and static sizing analysis. User modeling data was used in estimating the user access rates to the system where appropriate.

ACMHW —Analysis was undertaken primarily for the sizing of the APC server hosts and their attached disk storage. The Administration Stations are minimally configured workstations that perform various operations functions (e.g. DBMS administration). Client desktop services as well as X protocol access to other hosts are the driving selection factors for the workstations.

APC Server -- The APC server at ORNL provides the session establishment point for the client, routes service requests to the other CSCIs and HWCIs, and functions as the electronic channel for the DSS user access loads. APC server host runs the following software processes and applications: ScienceDataServer Process, ScienceDataServer Administration Process, SubscriptionServer Process, Network ResourceManager Process, PullMonitor Process, CSS DCE client, CSS logging API, and an MSS agent. The query load at the ORNL DAAC was modeled the same way as the NSIDC DAAC. The anticipated internal I/O is a negligible consideration in the choice of the platform.

The following is the CPU allocation (CPU loading for peripheral support is based on SGI configuration guidelines):

>   *0.5 CPU Monitoring/Managing Tasks (estimated)*
> +   *1 CPU Operating System and Applications (estimated)*
> +   *2.3 CPUs for client support (session threads)*
> +   *0.075 CPU for 1 Differential SCSI -II Interfaces (1 SCSI [disk] at 5 MB/sec -*
>   *7.5% of a CPU for each 5 MB/sec)*
> +   *0.02 CPUs for SCSI RAID controller support (1.5% of a CPU for each*
>   *5 MB/sec of controller I/O; 5.4*0.015/5)*
> +   *0.08 CPUs for FDDI I/O support (7.5% of a CPU for each*
>   *5 MB/sec of SCSI I/O: 5.4 MB/sec / 5 MB/sec * 0.075)*
> +   *0.03 CPUs in support of subscriptions (50% of estimated NSIDC subscriptions).*

This requires a total of 4.005 equivalent CPUs. The SGI Challenge L server with 4 CPUs and 256 MB of RAM will be selected as the APC server. The server will be equipped with 6 GB of local disk, 2 differential SCSI-II controllers for the local disk pool, 5 SCSI RAID Controllers (see *APC Host Storage* below), and 2 FDDI Interfaces. Failover will be provided by a second identically configured SGI Challenge L.

APC Host Storage -- The APC server host disk is sized for electronic user access. APC storage must also be sized to support the storage of user session context, which keeps track of user session interactions that may be suspended and resumed.

50 GB of RAID is allocated for APC associated staging space (approximately one half of the ORNL storage). An additional 50 GB of RAID is allowed for storing 1000 versions of session context per day for fifty days.

DRPHW — The DRPHW configuration at ORNL is limited to the DBMS based physical repository.

DBMS Repository—-The Data Base Management System (DBMS) Repository component was sized as follows based on static data size analysis as well as transaction based analysis. The transaction analysis is based on both "push" (production metadata update) and "pull" (user access and distribution) loads. Transaction rate was modeled based on the user service request rates as described at PDR time in the User Pull Analysis Notebook, 160-TP-004-001, Question 47 and a cross section of query types derived from the DBMS Benchmark Report, 430-TP-003-001.

The DBMS Server Host was sized based on the transaction analysis mentioned above, as well as platform suitability analysis based on the DBMS COTS software selection for Release B Data Servers (Illustra). Platform suitability is based on the DBMS software manufacturer's compatibility recommendations, benchmark data, and project bench marking activities. Aside from the Data Base engine, the following processes will run on this host: CSS DCE client, CSS logging API, and an MSS agent.

DBMS Server Disk was sized based on the V0 data sets identified for migration within Release B together with metadata associated with other data sets identified for migration with the Release B

timeframe. This timeframe is from 1997 through 1999. Refer to table 3.4.2.2-3 for DBMS Repository Sizing beyond the Release B timeframe. The size of the metadata granule for V0 was assumed to be half (0.91 KB) that of the full ECS metadata granule of 1.82 KB. That assumption is based on the 50% mapping of V0 attributes to ECS core attributes across all products throughout the Release A duration.

The key assumptions associated with the DBMS repository sizing are as follows:

- The products lists have been derived from the DAAC instrument teams representatives, the ECS Technical Baseline and in coordination with Science Metadata sizing for the SDSRV DBMS DRPHW CI.

- The period of data capture for Release A products on the TRMM mission is 8/17/97 to 12/31/98.

- The period of data capture for Release B is 1/1/1997 through 12/31/1999.

- All products are assumed to conform to the Proposed ECS Core Metadata Standard v2.0, 420-TP-001-005, Dec. 1994.

- The metadata sizing has been calculated from the Metadata Expected with each granule included in the table on Page 94 in the Proposed ECS Core Metadata Standard v2.0, 420-TP-001-005, Dec. 1994.

  The calculated size of 1.823 KB per granule has been obtained from this data source.

- An overhead factor of 2.36 for implementation in Illustra has been estimated based on the benchmarking activities as outlined in the DBMS Benchmark Report, 430-TP-003-001. This assumes a high level of query / insertion activity and a low level of update / deletion activity.

- An estimated overhead of 80 MB will be made for the Illustra product code. Note that this includes sizing for the Illustra database product, the 2-D Spatial Data Blade, and the 3-D Spatial Data Blade.

- All instruments on TRMM are considered to exist in the Data Server as a continuation of Release A.

- All instruments on AM-1 were included in the product lists.

- Keyword metadata per document is derived from Release A, phase2 DDSRV. Average size is 1727 bytes.

- Sizing for document metadata and storage is assumed during initial Release B operations because time phasing of document production is indeterminate.

- Sizing includes requirements for a RAID 5 overhead factor of 1.125.

Table 3.4.2.2-3. ORNL DBMS Repository Sizing (GB)

DAAC	1997	1998	1999	2000	2001	2002	EOC
ORNL	0.2	0.5	0.8	1.0	1.4	1.6	1.8

The calculated disk capacity for the ORNL repository (static analysis) results in a computed requirement of .8 GB. Due to the operational experience with the user space requirements, at least 5 GB of disk space must be allocated for a high use data base functioning. Therefore, at least 5 GB beyond the calculated storage requirement will be allocated - 5.8 GB. (The closest available quantity of disk equal or exceeding 5.8 GB will be purchased.) Dual host configuration will allow for failover. Host type will be a SGI L class machine.

Document Data Server — Document handling is handled via a dedicated Data Server implementation, geared to the predicted document ingest and access volumes and the nature of the COTS S/W requirements imposed on the support hardware. The Document Data Server is provided as a simple server configuration with network access. The following assumptions were made in the preparation of the ORNL Document Data Server configuration:

1. Documents and document metadata together have been considered as a basis for the sizing calculations.

2. Totals for MSFC are included in the GSFC totals.

3. Document related data includes: 5 guide document types, algorithm descriptions, production plans and reference papers. These from the DDSRV Detailed Design for ESDTs (DID 305).

4. Guide document sizes (5 guides) from Release A, phase 2 of DDSRV are sized at 1.5 MegaBytes each.

5. Production plans are assumed to be on per DAAC, sized at 1.0 MegaBytes each.

6. Reference papers are sized at 6.5 MegaBytes each; one per instrument per platform.

7. As a typical example of other documents, the CERES ATDB and LaRC Handbook file sizes were used as the size of Algorithm Documentation for each TRMM instrument. One ATBD is assumed per instrument.

9. Sizing includes requirements for a RAID 5 overhead factor of 1.125.

10. The figures are approximations, which will be refined over time. The Document Data Server architecture is scaleable.

11. The Document Data Server continues to exist as a separate server. As the design effort for Release B continues relative to the Sybase/Illustra selection, the Document Data Server could be collapsed into the DBMS Server. This would change the document storage sizing and cause it to be added into the DBMS Server sizing.

12. The entire document Data Server DBMS sizing is assumed to be available at the beginning of the Release B timeframe. This is to allow sufficient capacity to be available to handle

both historical document conversion and new document requirements. This includes the maximum required by the end of Release B.

A 2 CPU SMP server was selected based upon operational experience with the EDF EDHS. A WAIS-like, full text indexer, an http server, and additional custom developed software will reside on this host. The following processes/applications run on this host: Document Data Server Process, WWW Server Process, Document Repository Process, Client Applications Process, CSS DCE client, CSS logging API, and an MSS agent.

The disk complement was sized to hold the document metadata for the data product collections associated with the V0 data sets identified for migration. Sizing for document metadata was based on available V0 guide document sizing and the 2.0 Core metadata baseline. The calculated required disk capacity for all document collection alone is 7.8 GB.

3.4.2.2.2 Configuration

The specific sizing for the ORNL Data Servers, derived from the rationale described above, is synopsized below. Figure 3.4.2-1 provides the preliminary design for the site's configuration. Additional details on specific component configurations and sizing are provided within the figures.

For the ORNL Data Server:

ACMHW

- Admin. Workstations: 2 ea. of SUN Ultra

- APC Hosts: two 4 CPU SGI Challenge L, configured with 6 GB each of local disk, 256 MB RAM, and 100 GB RAID.

DRPHW

- DBMS Server: two of 2 CPU SGI Challenge L, with 10 GB of shared disk

For the ORNL Document Data Server....

- WAIS/http Data Server 2 of 2 CPU SMP Server

- Data Server Disk: 12 GB mirrored in two machines for Release-B

3.4.2.3 Data Management Subsystem

The Data Management Subsystem (DMS) consists of a single Hardware CI (HWCI) that will also support the Release B processing requirements of the Interoperability Subsystem (IOS) at the ORNL DAAC site.

The DMS is responsible for supporting Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manger CI and Distributed Information Manager CI processing activities generated directly from user "pull" search invocations. The DMGHW CI consists of three major components: 1) DBMS/Web Server, 2) Database Management Workstation, 3) Data Specialists and User Support Workstations.

The DBMS/Web server is the primary hardware component in the Data Management Subsystem. The server provides DBMS storage, input/output (I/O), and processing resources in support of the Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manager CI and Distributed Information Manager CI in Release B.

The DMGHW CI configuration provided in Section 3.4.2.3.2 depicts the Release B hardware design. The Release B hardware design accommodates Release B platform design issues concerning scalability, RMA and evolvability. The hardware design is tailored to Release B ORNL DAAC specific processing needs in support of Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manger CI and Distributed Information Manager CI processing functions. The Release B ORNL DMGHW CI is designed to support BOREAS, FIFE, OTTER, NPP and other mission datasets. Section 3.4.2.3.1 provides the rationale behind the recommended Release B hardware configuration and is subject to change as Data Management software CI (under investigation in the incremental development track) prototyping results become available.

3.4.2.3.1   Rationale

The performance drivers for sizing the DMGHW CI server for Release B are:

- User Characterization analysis of science and non-science user search invocations

- DBMS/CI transaction rate (performance) analysis

- DBMS/CI prototype/benchmark analysis

- Hardware Scalability / RMA / Evolvability Analysis

User Characterization Analysis — User Characterization data provides the projected number of science and non-science users, frequency of search invocations per time period, and the percentage of invocations for different types of searches to be supported in the Release B time frame. In Release B, it is expected that science users will primarily access the DM services (Gateway CI, Data Dictionary CI, Local Information Manager CI, Distributed Information Manager CI) while the bulk of the accesses to the Interoperability service (Advertising Service CI) will originate from within the non-science community.

It is assumed that non-science users will access the Advertising Service CI 86% of the time, and DM CIs 14% of the time as documented in "User Characterization and Requirements Analysis" (19400312TPW). The number of searches per hour being processed by the DM CIs in response to queries by science users is based on the ECS science user scenarios in which users are assumed to be accessing the system through the client. Because of the increasing popularity and ease of use of the WWW, it is also expected that science users will make use of the Advertising Service at a rate equal to 25% of DM searches. Data provided by the User Characterization Team apply to epoch m (first quarter of 2000) since the data are meant to represent maximum usage loading (this will occur at the end of Release B).

Tables 3.4.2.3-1 and 3.4.2.3-2 summarize the number of science user system accesses per day and the fraction of invocations per search type for DM services as documented by the User Characterization Team. Table 3.4.2.3-3 summarizes the total number of searches per hour for the

busiest hour of the day. Searches per hour for science users for the ORNL DAAC have been equated to searches per hour calculated for the NSIDC DAAC (in the absence of ORNL User Characterization data) as the volume and type of datasets for both DAACs are assumed to be similar.

Table 3.4.2.3-1. ORNL User System Accesses per Day for Science Users (Epoch m)

DAAC	User System Accesses per Day
ORNL	70

Table 3.4.2.3-2. ORNL Science User Search Types for Gateway CI Service (Epoch m)

Search Type	Fraction of Total Invocations
Simple Search/1 site	.263
Simple Search/multi-site	.279
Match-up Search/1 site	.272
Match-up Search/multi-site	.185
Coincident Search/1 site	0.0
Coincident Search/multi-site	.000374

Table 3.4.2.3-3. ORNL Searches per Hour for Science Users (Epoch m)

DAAC	Searches per Hour (busiest time of day)
ORNL	3

The data for searches submitted by science users is categorized into six different types (simple/1, simple/multi, match-up/1, match-up/multi, coincidence/1, and coincidence/multi) for DM services; however, there are only three types of searches for the non-science user data. Each of the three search types that exist in the non-science user data was subdivided into one-site vs. multi-site by applying the proportions of one-site vs. multi-site that exist for science users to the non-science user data. For example, the relative proportions of simple search/1 site and simple search/multi-site for science users is 0.263 and 0.279, respectively. The number of simple searches submitted by non-science users was divided into one-site and multi-site using these same proportions. Only one search type (simple/1) pertains to the Advertising Service CI.

Tables 3.4.2.3-4 and 3.4.2.3-5 summarize the number of non-science user system accesses per day and the fraction of search invocations for DM services as documented by the User Characterization Team. Searches per hour for non-science users for the ORNL DAAC have been equated to searches per hour calculated for the NSIDC DAAC (in the absence of ORNL User Characterization data) as the volume and type of datasets for both DAACs are assumed to be similar.

Table 3.4.2.3-4. ORNL User System Accesses per Day for Non-Science Users (Epoch m)

DAAC	User System Accesses per Day
ORNL	1150

Table 3.4.2.3-5. ORNL Non-Science User Search Types for Gateway CI service (Epoch m)

Search Type	Fraction of Total Invocations
Simple Search/1 site	.31
Simple Search/multi-site	.29
Match-up Search/1 site	.09
Match-up Search/multi-site	.06
Coincident Search/1 site	0.0
Coincident Search/multi-site	.25

DBMS Transaction Rate Analysis — In order to size the DBMS server it is necessary to estimate the size of the Interoperability (Advertising Service CI) and Data Management (Gateway CI, DDICT CI, LIMGR CI, DIMGR CI) services and then determine the transaction rates, or database throughput that must be provided in support of the "pull" search activities that will be invoked by the user community. The transaction rate analysis is based on assumptions regarding the amount of processing associated with the different types of search requests that pertain to the Interoperability and Data Management software CIs. Release B transaction assumptions were made to define a transaction loading value per search request. Number and type of search request are provided by the User Characterization Team. Depicted transaction loading values are assumptions that are based on search complexity. The loading values for search requests will be refined with actual performance benchmarks as future prototypes are completed. The observed transaction loading from future prototyping/benchmarking activities will be compared to the predicted ones (documented below) and the sizing analysis will be updated as a result (these transaction loading assumptions are defined as "nominal" cases). The transaction data provided is projected for the Release B time-frame.

The processing (transactions per search invocation) assumptions are based on preliminary transaction analysis results for the Advertising Service and DM CIs and will be revised based on future prototyping/benchmarking results as they become available. Tables 3.4.2.3-6 and 2.4.2.3-7 list the predicted transaction load associated with the Gateway CI and Advertising Service CI based on frequency of science user search invocations. Searches/hour are calculated for the busiest time of day at the ORNL DAAC site.

Tables 3.4.2.3-8 and 3.4.2.3-9 list the transaction analysis for the Gateway CI and Advertising Service CI based on daily non-science user accesses as depicted in "User Characterization and Requirements Analysis" (19400312TPW). The estimated total non-science user system accesses per day for the Gateway CI and the Advertising Service CI is estimated to be 1150. The percentage that each search type, pertaining to the Gateway CI and Advertising Service CI, is invoked is also taken from the same document. Tables 3.4.2.3-8 and 3.4.2.3-9 are completed with the assumption that there will be at least ten search invocations per non-science user access on average.

Table 3.4.2.3-6. ORNL Science User Transaction Analysis for Gateway CI Service (Epoch m)

Search Type	Percentage Invoked	Searches/hour	Processing Assumptions (Transactions per Search Type)	Transactions/ hour
Simple Search/1 Site	26.3	1	5	5
Simple Search/Multi-Site	27.9	1	20	20
Match-up Search/1 Site	27.2	1	5	5
Match-up Search/Multi-Site	18.5	1	20	20
Coincident Search/1 Site	0.0	0	5	0
Coincident Search/Multi-Site	.0374	0	25	0

Table 3.4.2.3-7. ORNL Science User Transaction Analysis for Advertising Service CI (Epoch m)

Search Type	Percentage Invoked	Searches/hour	Processing Assumptions (Transactions per Search Type)	Transactions/ hour
Simple Search/1 Site	100	1	5	5

Table 3.4.2.3-8. ORNL Non-Science User Transaction Analysis for Gateway CI Service (Epoch m)

Search Type	Percentage Invoked	Searches/hour	Processing Assumptions (Transactions per Search Type)	Transactions/ hour
Simple Search/1 Site	31	21	5	105
Simple Search/Multi-Site	29	20	10	200
Match-up Search/1 Site	09	6	5	35
Match-up Search/Multi-Site	06	4	10	40
Coincident Search/1 Site	0.0	0	5	0
Coincident Search/Multi-Site	25	17	25	425

Preliminary transaction analysis results for Interoperability and Data Management CI processes are depicted in Table 3.4.2.3-10. At this time the Data Dictionary CI transaction analysis is equated to the transaction analysis of the Advertising Service CI since the type and frequency of transactions are predicted to be very similar. Due to the fact that DIMGR and LIMGR CI processes are

perceived as being the most expensive (in terms of cost to the CPU), and that prototypes will not be developed until after Release B CDR, preliminary sizing estimates have been achieved by doubling the transaction load of the Gateway CI and applying the result to LIMGR CI and DIMGR CI processes. Although equating Advertising Service CI and Data Dictionary CI processes, and doubling the Gateway CI transaction load to produce LIMGR CI and DIMGR CI transaction loading does not pin-point the performance cost that will be levied on the DMGHW CI, it does provide preliminary, expected CPU activity in the absence of real-time prototyping/benchmarking results. The preliminary transaction results for the Advertising Service CI, Gateway CI, Data Dictionary CI, LIMGR CI and DIMGR CI will be revised based on future prototyping/benchmarking analysis results as the Incremental Track software design matures.

Table 3.4.2.3-10 summarizes the science, and non-science user transaction loading per hour for the Advertising Service CI , Gateway CI, Data Dictionary CI, LIMGR CI and DIMGR CI services.

Table 3.4.2.3-9.   ORNL Non-Science User Transaction Analysis for Advertising Service CI (Epoch m)

Search Type	Percentage Invoked	Searches/hour	Processing Assumptions (Transactions per Search Type)	Transactions/hour
Simple Search/1 Site	100	412	5	2060

Table 3.4.2.3-10.   DBMS Transaction Analysis Summary (Epoch m)

DAAC	User Type	Service	Searches/hour	Transactions/ hour	TPM
ORNL	Science	Gateway	4	50	1
ORNL	Science	Advertising	1	5	.1
ORNL	Science	Data Dictionary	1	5	.1
ORNL	Science	LIMGR	8	100	2
ORNL	Science	DIMGR	8	100	2
ORNL	Non-Science	Gateway	68	805	13
ORNL	Non-Science	Advertising	412	2060	34
ORNL	Non-Science	Data Dictionary	412	2060	34
ORNL	Non-Science	LIMGR	136	1610	27
ORNL	Non-Science	DIMGR	136	1610	27
Totals:			1186	8405	140

305-CD-037-002

A sensitivity analysis has been performed with larger loading allocations; the results are depicted below in Table 3.4.2.3-11.

Table 3.4.2.3-11.   DBMS Transaction Sensitivity Analysis Results (Epoch m)

DAAC	User Type	Service	Searches/hour	Transactions/ hour	TPM
ORNL	Science	Gateway	8	200	3
ORNL	Science	Advertising	2	20	.3
ORNL	Science	Data Dictionary	2	20	.3
ORNL	Science	LIMGR	16	400	7
ORNL	Science	DIMGR	16	400	7
ORNL	Non-Science	Gateway	136	3200	53
ORNL	Non-Science	Advertising	824	8240	137
ORNL	Non-Science	Data Dictionary	824	8240	137
ORNL	Non-Science	LIMGR	272	6400	107
ORNL	Non-Science	DIMGR	272	6400	107
Totals:			2372	33520	559

Future Incremental Track Development prototyping/benchmarking activities will provide a more detailed performance analysis of Advertising Service CI, Gateway CI, Data Dictionary CI, Local Information Manager CI and Distributed Information Manager CI processes; therefore, performance transaction analyses will be revised accordingly.

DBMS Prototyping/Benchmarking Analysis — Currently, preliminary Incremental Track Development performance data is being used to size the processing capacity of the DMGHW CI DBMS/Web server. Performance analysis results will be revised as planned prototyping/benchmarking activities are completed. Major prototyping activities that will affect performance estimates for the DMGHW CI include, but are not limited to: 1) Prototype workshop 2, 2) EP7 prototype.

DBMS performance estimates provided in "DBMS Benchmark Report" technical paper (430-TP-003-001), show that for multi-user (32 users) queries (20 similar queries accessing different parts of the test database) running concurrently, the test-bed platform's CPU became saturated (SUN SPARCstation 20/50). A vendor supplied TPM benchmark for the selected platform (HP K400) for Release B operations is shown in Table 3.4.2.3-12. As a rule vendor supplied Transaction Per Second/Minute (TPS/TPM) ratings tend to be a maximum, or high-end value and do not take into account processing overhead associated with other system processes. Processes that will run on the DMGHW CI in Release B include DCE client, MSS agent, HTTP server, Sybase SQL Server, Sybase Replication Server, Sybase Backup Server, Operating System Services, Advertising Service Server, Gateway Server, Data Dictionary Server, LIMGR Server and DIMGR Server.

Table 3.4.2.3-12.   Vendor Platform Performance Estimates

Platform	TPM	MIPS
HP K400 (SMP) with 1 processor (PA 7200 CPU)	1000	146

Disk Capacity Sizing — Disk storage for the DMGHW CI has been determined for each DAAC site based on preliminary Interoperability and Data Management CI DBMS application sizing estimates plus vendor inputs for the following COTS software: 1) DBMS software, 2) Development software, 3) HTTP server software, 4) Operating System software, 5) Communications and Utilities software. Capacity sizing for the Interoperability and Data Management databases was achieved by multiplying the expected byte size for core and collection specific attribute definitions by the total number of core and collection specific attributes. Temporary workspace has also been allocated for Interoperability CI and Data Management CI services dependent on frequency and variation of queries. For example, the DIMGR service has a larger capacity requirement than the Data Dictionary service because it requires more temporary workspace since it handles a greater number and more varied types of queries. The expected capacity of Interoperability CI, Data Management CI, COTS, Operating System and Communications and Utilities software to be installed on the DMGHW CI at the Release B ORNL DAAC site is depicted in Table 3.4.2.3-13.

Table 3.4.2.3-13. DMGHW CI Disk Capacity Requirement

S/W Component	Release B Capacity
COTS Software:	
Sybase System	300 MB
HTTP Server	10 MB
	Total: 310 MB
Databases:	
Sybase Master Database	3 MB
Sybase Tempdb Database	100 MB
Sybase Model Database	2 MB
Advertising Database	150 MB (Estimate)
Advertising DB Workspace	150 MB (Estimate)
Advertising DB Log	100 MB (Estimate)
Advertising HTML Files	100 MB (Estimate)
Data Dictionary Database	400 MB (Estimate)
Data Dictionary DB log	100 MB (Estimate)
DMS Working Store Database	500 MB (Estimate)
DMS Working Store DB log	100 MB (Estimate)
	Total: 1705 MB
Operating System & Utilities:	
Operating System Software	700 MB
Utilities	200 MB (Estimate)
DCE Client	46 MB
	Total: 946 MB
	Total: 2961 MB

Table 3.4.2.3-13 is filled with preliminary disk sizing results for Release B Interoperability and Data Management software CIs, operational databases and COTS software packages that will be installed on the DMGHW CI at the ORNL DAAC site. Some of the results are estimates (such as database sizes) since the DBMS design will mature and impact disk capacity sizing as the Advertising Service CI, Gateway CI, Data Dictionary CI, Local Information Manager CI, and Distributed Information Manager CI under-go future evaluation and prototyping.

3.4.2.3.2 Configuration

The selected DMGHW CI DBMS/Web server to be implemented in Release B is a low-end SMP server (HP K400) that is scaleable from one to four processors. A single physical DBMS/Web server will be implemented at the Release B ORNL DAAC site. At this time a two CPU configuration has been determined to be appropriate for the DMGHW CI DBMS/Web server due to RMA requirements. The Release B HP K400 single server configuration will offer redundancy in the form of: 1) dual processors, 2) dual power supply units, 3) dual FWD SCSI-2 cards, and 4) dual FDDI network cards 5) duplicate OS boot/application disk. The components listed above are hot swap-able units which allow them to be replaced without shutting down the server. Also, the HP-UX operating system features memory page de-allocation which automatically blocks out any portion of memory in which an error has been detected; therefore, a failure to memory will not bring operations to a halt. The single server host configuration will allow applications to be run in parallel across both processors, which enhances load balancing and availability/recovery capabilities. The DMGHW CI DBMS/Web server will automatically reconfigure itself in a single CPU configuration in the event of failure to a single CPU. The dual power supply units, FWD SCSI-2 cards and FDDI network cards will also provide continued availability in the case of failure to a single component (per function). The redundant configuration of the DMGHW CI DBMS/Web server has been analyzed by the ECS Reliability Engineering Group using COTS vendor provided data to ensure that all functional availability requirements are met. Preliminary analysis results revealed that the DMGHW CI DBMS/Web server has an MTBF (mean-time-between-failures) of greater than 20,000 hours which meets all pertinent RMA requirements.

A RAID disk unit will be attached via FWD SCSI-2 (dual ported) to the DMGHW CI DBMS/Web server (see Figure 3.4.2-2). The RAID disk until will provide operational and mirrored sets of disk devices to the DMGHW CI server in order to provide uninterrupted data availability in the event of a disk failure. The RAID disk configuration will also be implemented such that a failure to a single disk will be recoverable via a "hot-swap" disk capability. The RAID disk until will be comprised of ten disks: five operational and five mirror disks. Each disk contained in the RAID unit will provide a capacity of 2.1GB.

Since the Release B processing requirements for the Local Information Manager CI and Distributed Information Manager CI are largely unknown at this time, the flexibility of the recommended hardware design assures minimum risk. The design allows for 100% growth in both processing and storage capacity in support of the Advertising Service, Gateway, Data Dictionary, Local Information Manager and Distributed Information Manager CIs in Release B.

The following configuration diagram, Figure 3.4.2-2, depicts the recommended server host/RAID disk unit configuration:
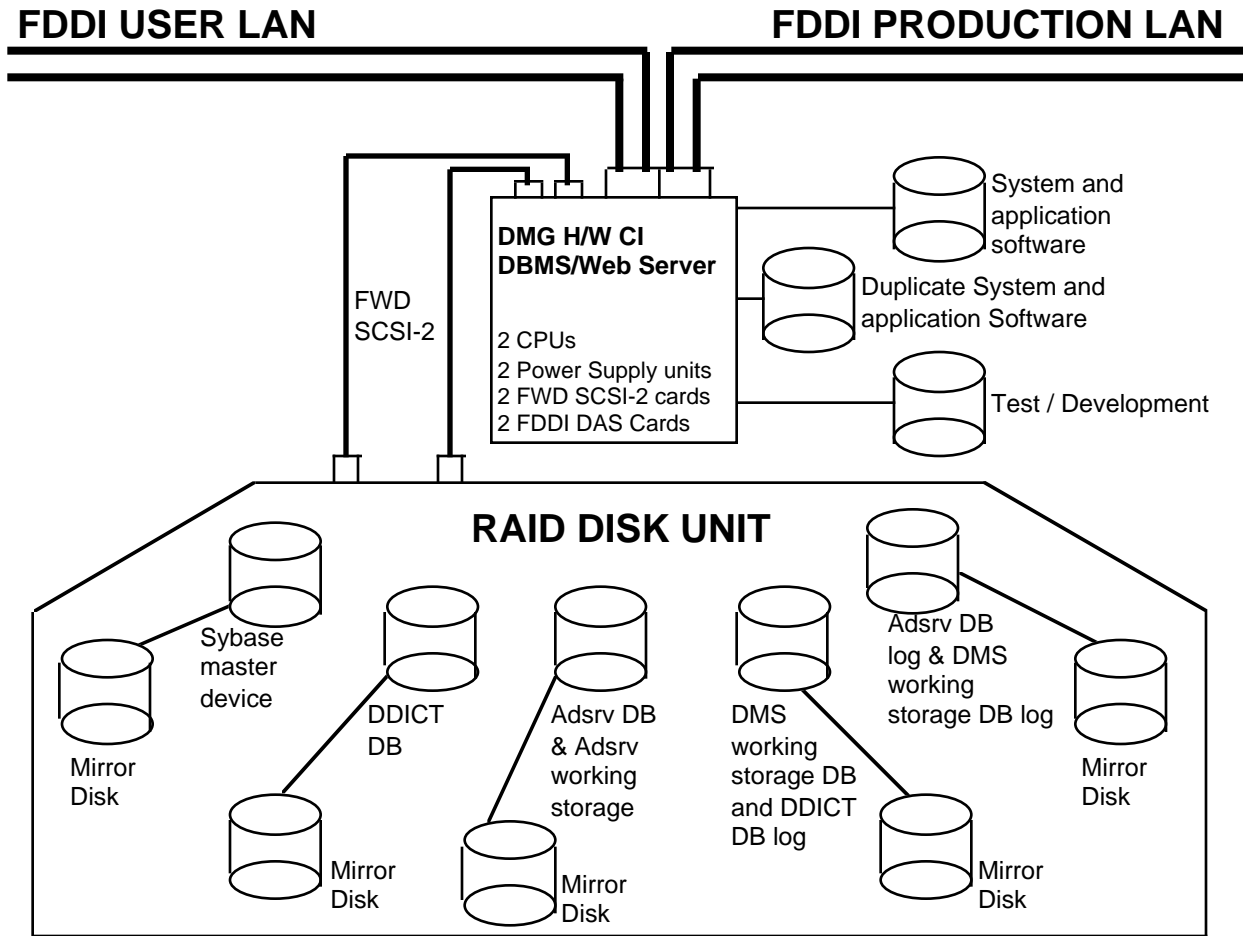
FDDI USER LAN

FDDI PRODUCTION LAN

DMG H/W CI
DBMS/Web Server

FWD
SCSI-2

2 CPUs
2 Power Supply units
2 FWD SCSI-2 cards
2 FDDI DAS Cards

System and
application
software

Duplicate System and
application Software

Test / Development

RAID DISK UNIT

Sybase
master
device

Mirror
Disk

DDICT
DB

Mirror
Disk

Adsrv DB
& Adsrv
working
storage

Mirror
Disk

DMS
working
storage DB
and DDICT
DB log

Adsrv DB
log & DMS
working
storage DB log

Mirror
Disk

Mirror
Disk

Figure 3.4.2-2 DMGHW CI RAID Disk Configuration

Although the estimates for Advertising Service and Data Management operational databases, COTS software, and operating system and utilities sizing are relatively small, the total disk volume for the DMGHW CI server has been increased in support of Sybase swap (workspace) area, 100% growth capacity for the core operational software, and mirror disk units. The Data Management databases will be replicated (using Sybase replication server) at each DAAC site. The Interoperability and Data Management software CIs will be distributed over multiple disk drives contained in the RAID disk unit in order to enhance performance (vendor and developer recommended); therefore, the total disk volume is well above the actual capacity needed to support the software alone. Additional disk capacity (internal to the server) in the form of a redundant system/application disk, and a test/development disk have also been added to the configuration in support of RMA, and integration and test requirements.

A single 8mm tape drive unit will be configured on the DMGHW CI server in Release B. The 8mm tape drives will be used to backup Advertising Service and Data Management CIs/databases, as well as perform DBA and routine maintenance operations.

A low-end DBMS/DBA uniprocessor workstation will be used for database/system administration activities. A single 8mm tape drive unit will be configured on the DBMS/DBA workstation in Release B. The 8mm tape drive will perform backup/recovery and routine maintenance operations in support of the DMGHW CI DBMS/Web host servers. A small pool of low-end uniprocessor workstations will support Data Specialist/User Support operations. At a minimum the DBMS/DBA and Data Specialist/User Support workstations will be configured with six gigabytes of local disk each. Workstation disk capacities were sized based on IR-1 workstation installation results which included recommendations for additional space per workstation to accommodate the following: 1) User/Temp workspace, 2) Personal development space, 3) Testing, 4) Software upgrades, 5) Working with large files/datasets, 6) future growth/flexibility. Exact capacities for disk drives are dependent on the procurement process as the type, and size of disks being offered for workstation platforms may fluctuate.

Table 3.4.2.3-14 summarizes the recommended DMGHW CI processing configuration for implementation at the Release B ORNL DAAC.

NOTE: The HP K400 SMP depicted in Table 3.4.2.3-14 is a low-end SMP class server that is scaleable from 1-4 CPUs.

Table 3.4.2.3-14. ORNL DAAC DMGHW Hardware Configuration

Component	Class/Type	Platform	Qty.	Number of Processors	Memory	Disk Capacity
DBMS/Web Server	SMP	HP K400	1	2	512 MB	27.3 GB
DBA Workstation	Uniprocessor	HP C100/64	1	1	64 MB	6 GB
Data Specialist and User Support Workstations	Uniprocessor	SUN UltraSparc 140	2	1 (each)	64 MB (each)	6 GB (each)

DBMS/Web Server Platform Technical Specifications:

   Make: Hewlett Packard

   Model: K400 (Low-End SMP class server)

   CPU: PA7200 (upgradeable to future PA800 processor)

   Clock Frequency: 100 MHz

   Number of processors: 1 to 4

   MIPS: 146 (1 processor)

   TPM: 1000 (1 processor)   3160 (4 processors)

SPECint92: 136 (1 processor)

SPECfp92: 215 (1 processor)

Memory: Expandable to 2GB RAM

Internal Processor-Memory bus bandwidth: 960 MB/sec (peak)

I/O Bandwidth: 128 MB/sec (peak)

3.4.2.4 Ingest Subsystem

This DAAC facility does not ingest L0 data, therefore no hardware support is required for the Ingest subsystem.

3.4.2.5 Interoperability Subsystem

For the Release B time frame, the hardware support for the Interoperability Subsystem, particularly the Advertising capabilities are provided by the Data Management HWCI. Please see Section 3.4.2.3 for a complete description of this capability.

3.4.2.6 Production Planning Subsystem

This DAAC facility has no ECS production operations, therefore, no hardware support for the Planning Subsystem is required.

3.4.2.7 Data Processing Subsystem

This DAAC facility has no ECS production operations, therefore, no hardware support for the Data Processing Subsystem is required.

3.4.2.8 MSS and CSS Subsystems

The MSS and CSS Subsystem hardware have been sized and configured in a redundant configuration in order to provide for high availability of communications infrastructure and management services. The sizing rationale, therefore, applies to both MSS and CSS servers and will be presented in a single subsection.

The MSS Subsystem consists of a single hardware configuration item (MSS-MHWCI), which provides the servers, workstations, and printers needed for all local system management functions. The MSS-MHWCI provides processing and storage for the following MSS software components:

- Management Software Configuration Item (MCI) - provides system monitoring and control (via HP Openview), the database management system (Sybase), trouble ticketing (Remedy), fault and performance management (Tivoli), physical configuration management (Accugraph), security management, accountability management, billing and accounting system, mode management service, performance trending capability, report generation and distribution, and management data access (custom code/scripts used to import log file data to the relational data base management system)

- Management Logistic Configuration Item (MLCI) - Site and SMC maintenance and operations staffs will rely on configuration management to provide software change control (ClearCase), change request management (DDTS), baseline management (XRP), inventory/logistics/maintenance (ILM) management, training management, policy and procedure management, software distribution management (Tivoli), and software license management.

- Management Agent Configuration Item (MACI) - Agents are processes used to monitor and/or control managed objects distributed across heterogeneous platforms. Current COTS technology for network management uses network protocols such as simple network management protocol (SNMP to provide a way for the manager, the managed objects, and their agents to communicate. SNMP defines specific messages, referred to as commands, responses, and notifications.

The CSS Subsystem consists of a single hardware CI (CSS-DCHWCI), which provides the server for all CSS functionality. CSS contains a single CI, the Distributed Communications CI, which provides the following services:

- Common Facility Services - includes electronic mail, file access, bulletin board, virtual terminal, and event logger services

- Object Services - includes security, naming, message passing, event, thread, time and life cycle services

- Distributed Object Framework - includes OODCE framework functionality.

3.4.2.8.1 Rationale

The MSS/CSS processing complement for ORNL was designed and sized for both the TRMM and AM-1 missions. The sizing of MSS/CSS subsystem hardware is based on the February 1996 version of the technical baseline. Storage requirements have been rounded upward.

Processing Requirements — Processing requirements for the MSS and CSS subsystem are driven by the following types of transactions:

- HP Openview data collection from managed objects and ad hoc queries (server)

- Conversion / import of HP Openview and log file data to MSS Sybase DBMS (server)

- DBMS usage for report generation / ad hoc queries (server)

- Fault management notification (server)

- Trouble ticketing (server)

- Order request tracking (server)

- Billing & accounting (workstation)

- Mode management (server)

- Usage for configuration, baseline, training, license, inventory, change request, software distribution and maintenance type management services, and associated report generation (workstation)
- DCE logical server transactions (directory, security, time).

Server Sizing — ECS already has experience with many of the COTS products to be loaded on the MSS server from previous work in Evaluation Packages (EPs) and EDF installations. Based on this experience, a profile of the MSS/CSS server that is operating under nominal load (e.g., HP Openview map is displayed, but no collections are in process) has been developed. To this, processing requirements have been added for specific types of transactions.

In the EDF, an HP 9000/735/125, rated at 160 MIPS, was loaded with HP Openview, DCE client, Sybase server, X-server, and operating system. Tests were run to examine the impact of various types of HP Openview functions on CPU utilization. HP Openview was configured to discover approximately 500 nodes within EDF and then displayed them as a node map. Minimal status polling was performed at 15 minute intervals. A variety of HP Openview on-line reports were generated to show such items as packet throughput and CPU utilization. During the testing, processes resident on the server were monitored. CPU utilization remained extremely low (i.e., less than 3%) except during operator queries and initialization. At system start-up, initialization of the various daemons used by HP Openview generated a load of approximately 50%. After start-up, functions that involved initialization of x-windows screens (e.g., generation of the node map or display of a performance graph) generated loads of 25-40% for a brief (less than 15 seconds) period of time. Multiple SNMP queries on a router increased CPU usage to approximately 20 percent, with the primary driver appearing to be the x-windows server. Simultaneous queries of two routers (to two different x-window screens) consumed a total of 50-60% of the CPU. Based on this benchmark, we assume that a basic configuration of a server, including HP Openview, Sybase, DCE client, and the operating system will require approximately 72 MIPS, and will provide adequate resources for routine HP Openview operations. To this must be added processing capacity to handle DCE server functions, HP Openview monitoring, processing of log files, Sybase report generation / ad hoc query capability, Remedy trouble ticketing, Tivoli monitoring, Tivoli software distribution management, mode management, order request tracking, and mail.

HP Openview and log file-to-Sybase data conversion are primary processing drivers that are expected to vary by DAAC. Table 3.4.2.8.1-1 shows estimated numbers of transactions for HP Openview data collection. HP Openview data collection is driven by the number of managed objects to be monitored and the number and frequency of management information base (MIB objects to be collected for each. Managed objects for each MIB type were counted based on the Release B hardware configuration for ORNL. The number and frequency of data collection for each class of managed objects was provided by MSS developers as specified in the CSMS Database Design and Database Schema Specification, (311-CD-003-003, Appendix B). HP Openview provided an estimate of 100,000 instructions per transaction. Using this information, an average number of instructions per second required for HP Openview data collection was developed. These estimates appear to be reasonably in line with HP-provided performance information, which indicates that an HP 9000/735, a machine rated at 125 MIPS, is capable of performing approximately 1300 collections per second.

Table 3.4.2.8.1-1. ORNL HP Openview Collection Processing Requirement

	# MIB Objects	Average Size (Bytes)	ORNL Managed Objects	Collections per hour*	Collections per second	Estimated MIPS
Release B ORNL (Hosts, RDBMS, Router, hubs)	1,953	4	81	60,357	17	1.7

* Note that the number of collections per hour was derived by multiplying each class of MIB objects (e.g., MIB II objects) by the number of managed objects within that class, and summing the results.

An estimate of 100,000 instructions per transaction was assumed for the conversion of each logged event to Sybase, based on the number of source lines of code for the MSS MDA component involved and an estimate of instructions needed to update the Sybase database. Instructions per transaction was multiplied by the number of logged events, including both HP Openview events and events collected from applications via the logging API. HP Openview events (transactions) are described in the previous paragraph. The number of application-generated entries was developed using the following assumptions:

- One log entry (average 192 bytes each) is generated for every system transaction, by every process that is included in the transaction thread.

- The number of "pull" transactions is based on the user model and reflects user service requests by DAAC. Pull transactions (e.g., directory, inventory search requests) are assumed to generate a conservative estimate of 10 log entries each from CIDM and data server processes.

- Order request tracking is dependent on the request for data by a user and the request for status of a data product by a user. For every user request for data, an EcRequest is stored in the management DBMS and updated as required by the DSS. The transaction frequency for EcRequest storage is related to the number of granules requested by user per DAAC. Updates made by the DSS to the EcRequest are considered to be a small percentage of the total granules requested. For every user request for status of a product, the appropriate EcRequest is retrieved from the management DBMS and made available to the client.

- In addition, major processes generate log entries of approximately 512 K (based on the MSS application MIB) once every 15 minutes. There are estimated to be 15 processes at each DAAC that will generate log entries every 15 minutes.

- Log files and HP Openview data will be kept for 14 days prior to archiving in long-term Data Server Storage.

- For Billing & Accounting, there are expected to be approximately 17,000 total daily user accounts. Each account will be logged and on demand available for information tracking. An approximate number of user accounts per DAAC was estimated from the February 1996 user pull technical baseline.

305-CD-037-002

- To implement the mode management service, multiple modes are assigned to each logged activity and can be simultaneously executed. The overhead required to provide mode management capability is estimated at 30% of the total logged activity.

Log entry storage volumes are given in Table 3.4.2.8.1-2.

The MIPs required to import the total number of log files per day are given in Table 3.4.2.8.1-3.

Table 3.4.2.8.1-2. ORNL Log Entry Storage Volume - Release B

Log File	Log Events per Transaction	Transaction Frequency per Hour	Total Logged Events per Hour	Bytes per Transaction	Total Size of Bytes/Hr	14-Day Storage Requirements (MB)
User requests	10	24	240	420	100,800	34
Request tracking	10	12	120	420	50,400	17
Application MIB poll	15	7	105	512	53,760	18
Billing & accounting activity logging	2	36	72	420	30,240	11
Subtotal Rel B			537		235,200	80
Total Rel B (includes x30% for multiple modes)			698		305,760	104

Table 3.4.2.8.1-3. MDA Data Conversion to Sybase Processing Requirement

	Total HP Openview Events / Day	Total Log File Events / Day	MIPS for 8 hour Sybase import
Release B	1,448,568	16,752	6

At Release B, ad-hoc queries will be performed and statistical analysis collected from the Sybase database. Ad-hoc reports will be generated that include the following type of information; user accesses, trend analysis, fault occurrences, resource utilization, data production jobs and security events. Benchmarks are being run on a prototype Sybase database to evaluate performance. The

305-CD-037-002

prototype database was developed to do real-time benchmarking queries of designated working attributes that are expected to be of reporting interest (i.e. performance).

DCE has been installed in the EDF and used in the Engineering Packages (EPs). Running on an HP 715, rated at 77 MIPS, the DCE server functions used 8% of the CPU, or approximately 6 MIPS. An analysis was performed to determine how much additional load would be placed on the DCE server at Release B.

Load imposed on the DCE server is a function of the number of directory, security and time look-ups from client applications. A client application maintains its own cache containing the most recently accessed directory and security information, and will only access the server when a user is not found in its own cache. Many client applications will only access other clients in the DAAC, and so will never exceed their cache. CIDM and the Data Server APC, however, will be directly accessed by external user clients and so will need to access directory and security information for each user access. At ORNL, the user model reflects a maximum of 69 users accessing per hour. Given that a directory and security lookup typically requires less than 0.5 seconds, it is unlikely that there will be more than 1-2 simultaneous hits on the DCE server. We estimate that 1 additional MIP processor capacity will be sufficient for the level of DCE accesses required.

In the EDF "Mini DAAC" facility, Tivoli performance was evaluated on an HP 9000 J210/1 rated at 176 MIPS and with 256 MB of RAM. The Tivoli COTS package will be used primarily for performance management, fault management and software distribution (most likely through Tivoli Courier). Performance will be monitored, statistics collected, and faults detected via Tivoli GUI screens. Tests were run to determine Tivoli GUI screen CPU utilization. The benchmark was performed with one user and the following configuration; the Tivoli application, the platform operating system, xwindows, and the performance tool (glance plus). CPU utilization was minimal as expected with no applications running (.5% of the system CPU) and approximately 56 processes active.

Following initialization of the Tivoli application, CPU utilization remained low (<2%), with the Tivoli Management Enterprise (TME) desktop enabled and 61 processes active. CPU loading became more prevalent when an administration GUI was selected from the TME desktop. Peak utilization was recorded at 9% of the system CPU for a period of 10 seconds and 73 processes active. Max peak CPU utilization (approximately 11%) and IO throughput (13.5 MB/s) was recorded when enabling the policy region desktop. In steady state, CPU utilization measured approximately 3% of the system CPU. Opening multiple GUIs did not increase demands on CPU utilization (remained <11%) but linearly required more memory. The Tivoli vendor for this reason recommends 96 MB of RAM dedicated. Total CPU utilization allocation for Tivoli based on benchmark results is estimated at 11% of the system CPU or 20 MIPS. The targeted platform at each DAAC site will be upgraded from the platform used for benchmark calculations. Recognizing the emphasis by Tivoli for memory and moderate processing needs, additional processing and memory capabilities were added to the MSS management server in Release B to provide adequate resources in support of the Tivoli product.

Remedy was evaluated on the HP 9000/735/125 for CPU utilization. The application required very little CPU allocation (<1%). A more significant load was present when performing browse or ticket assignment functions (approximately 6%). Submittal and processing of a trouble ticket required less than 1% of the CPU capacity.

The server requirements, as dictated by the rationale given above, is synopsized in Table 3.4.2.8.1-4.

Table 3.4.2.8.1-4. CSS/MSS Server Configuration - Requirements Estimate

Server Load Sources	Estimated R-B MIPS
Basic configuration (includes HP Openview and DCE client)*	72
Additional HP Openview data collection*	2
Sybase Server and Client*	50
Tivoli *	20
Remedy	11
MDA (log conversion to Sybase)	6
MSS Agent*	3
DCE server (including additional processing for peak directory and security transactions)*	7
Word Processor	1
Spreadsheet	1
Other Common Services (Mail, file transfer, etc.)*	5
Total	159
*These items were considered to be potentially active at the same time. MDA database update is assumed to be run in off-peak hours, and not concurrently with Sybase report generation functions.	

Workstation Sizing — There will be two MSS workstations at each DAAC site. Workstation #1 will primarily contain the MLCI software. This includes software change management (ClearCase), change request management (DDTS), baseline control management (XRP), software license manager and inventory/logistics/maintenance (ILM) management. Policy & procedures management and training management will be configured on workstation #2. Each MSS Workstation will contain the Sybase client, DCE client, Tivoli client, MSS agent, and operator tools.

The DDTS tool was evaluated for performance in the EDF facility on a Sun Sparc 20/50 rated at approximately 130 MIPS and 64 MB of RAM (DAAC targeted platform will be an upgrade version). DDTS is the change request manager and maintains and tracks potential changes (via configuration change requests) to the ECS System. Configuration change requests (CCRs) will be created, logged into the DDTS database and tracked by a CM specialist. Tests were performed to determine CPU utilization for implementation of these tasks. The benchmark was performed with

one user, the DDTS application configured with the platform operating system, xwindows and the performance tool (proctool). Following initialization of the DDTS application, CPU utilization as expected was very low, <1%. For each instance that a CCR was either submitted, modified or logged, the CPU utilization remained below 3% and memory utilization less than 8%. Table 3.4.2.1-5 shows that processing utilizations increased significantly when queries were made to the DDTS database.

Table 3.4.2.8.1-5. DDTS Benchmark Results

Benchmark Test	# Records	CPU Utilization (% of system CPU)	Memory Utilization (% of system memory)	IO Throughput (KB/s)
CCR submittal/creation	-	1.4 %	6.6 %	4
CCR registration	-	2.3 %	7.1 %	4
EP4 database query	128	9.7 %	7.2 %	11.3
EP6 database query	279	13.5 %	7.3 %	11.7
EP4 + EP6 database query	407	16.5 %	7.5 %	11.8
DDTS (inclusive) database query	1232	30.8 %	7.5 %	12.2

CPU utilizations ranged from 10% of the system CPU to approximately 30%. The number of records in the development environment is expected to be substantially higher than at the DAAC sites. For this reason, a conservative estimate of a maximum of 400 records is used to result in a CPU utilization allocation of approximately 21 MIPS. Memory utilization and IO throughput were moderate and appeared constant for each test performed.

Processing requirements for baseline management COTS (XRP), was estimated from vendor specifications. For a 30 user system, the XRP vendor specifies a processing requirement of 100 MIPS. Each DAAC site is assigned to have 2 XRP users and therefore will require approximately 7 MIPS.

Vendor specifications suggest an allocation of 35 MIPS for the ClearCase Virgin Object Base (VOB) Server. The VOB server is the most compute intensive of the ClearCase server applications due to its required database processing. In the EDF, ClearCase was installed on a SPARCstation 10, equipped with 120 MB RAM, rated at 109 MIPS, and with an ethernet interface. The SPARCstation 10 was initially used for Tool kit development, as well as CM of the Evaluation Packages. With moderate numbers of users, the SPARCstation 10 provided good performance. At peak use (15-20 simultaneous users viewing items, manipulating the contents of the database, and executing directly out of ClearCase), performance was adversely affected. Usage at the DAAC is not anticipated to require more than 5 simultaneous users, frequency of use is anticipated to be much lower, and applications will not be executed from the ClearCase tool. Additional benchmarks will be run as ECS code and science algorithms become available to help determine the precise ClearCase processing requirements at the DAAC. EDF experience suggests that a workstation configuration in the SPARCstation 20 range should be adequate to support ClearCase, other MLCI COTS, DCE and billing & accounting and Tivoli clients.

On MSS Workstation #2, the COTS products expected to exert the larger processing loads are billing and accounting (B&A) and performance trending. Other primary load contributions come from training management, policy and procedures, and the DBMS report generator.

Major B&A processing loads will occur during nightly batch imports to the Sybase server which is not resident to MSS Workstation #2. Processing of B&A transactions such as accounts received, purchase orders placed and products delivered are expected to exert a moderate load on the MSS Workstation due to the expected number of user requests for data as provided by user modeling.

Selection for the performance trending statistical analysis package is in progress. Statistical and historical performance data will be analyzed to assure optimum usage of system resources. A determined number of performance attributes will be analyzed by the statistical tool. Performance trending and other resident COTS packages such as training manager, policy and procedure manager and DBMS report generator are expected to require a small to moderate load on the MSS Workstation.

Tables 3.4.2.8.1-6 and 3.4.2.8.1-7 show configuration requirements for the MSS workstations. They reflect a best estimate of load to be imposed on each MSS workstation. It assumes that most functions run concurrently. Operator functions can be spread across workstations in such a way as to balance processing loads.

Table 3.4.2.8.1-6. MSS Workstation #1 Configuration - Requirements

Workstation Load Sources	Estimated MIPS
Basic configuration (includes ClearCase and Operating System)*	50
Software License Management*	5
DDTS*	21
XRP*	7
Tivoli Client*	5
Sybase Client*	10
Word Processor	1
Spreadsheet	2
Graphics	1
Inventory/Logistics/Maintenance Management	15
MSS Agent*	2
DCE Client*	5
B&A Client*	5
Other Common Services (Mail, file transfer, etc.)	5
Total * These items are considered to be potentially active at the same time	110

Table 3.4.2.8.1-7. MSS Workstation #2 Configuration - Requirements

Workstation Load Sources	Estimated MIPS
Basic configuration (includes Billing & Accounting and Operating System)*	35
Training Management*	5
Performance Trending*	15
DBMS Report Generation*	10
Policy & Procedures*	5
Tivoli Client*	5
Sybase Client*	10
ClearCase Client*	10
Word Processor	1
Spreadsheet	2
Graphics	1
MSS Agent*	2
DCE Client*	5
Other Common Services (Mail, file transfer, etc.)	5
Total	102
*These items are considered to be potentially active at the same time	

Storage Requirements — Major datastores for the MSS and CSS subsystems include: HP Openview files, application log files (including request order tracking, billing & accounting and mode management), the Management DBMS, and ClearCase-managed data for software change management.

Other datastores include DCE directory, security data, mail, trouble ticketing, Tivoli, DDTS, baseline control management data (XRP), ILM, billing & accounting client, training management, policy & procedures, and DBMS report generation.

The size of the data storage for HP Openview has been estimated from the determination of the frequency of transmission of the necessary information of all the appropriate attributes of the managed objects during one hour period. It was assumed that fourteen days worth of HP Openview data are stored.

A description of how application log file volume was estimated is in the previous section (Processing Requirements). Log file volume is provided in Table 3.4.2.8.1-2 based on an assumption of fourteen days storage prior to archiving in the data server archive.

The storage requirement for the Management DBMS was based on a worst case assumption that all the records from both the log files and HP Openview are stored in the Management DBMS, with an additional 10% for table overhead and summarization records. It is assumed that one months worth of data are maintained in the Management DBMS at a time.

Storage requirements for ClearCase are based on the assumption that ClearCase will store two copies of all source code (including ECS application source and algorithms) and two copies of all executables. This will enable recovery of the previous version of any application if required. In addition, ClearCase will store test data and configuration files.

Tivoli sizing estimates are based on the number of performance attributes that will be monitored as specified by MSS developers in the Release B CSMS System Management Subsystem Design Specification, (305-CD-029-001, section 6.6). These include system, application, process, and disk performance metrics. The monitoring frequency is dependent on the performance attribute. A worst case polling frequency of once per minute for all attributes was used in sizing calculations. The size of a typical fault/performance notification was estimated at 256 bytes.

Approximately 400 trouble tickets per day are estimated to be assigned, or approximately 17 per hour. The size of a trouble ticket is approximately 256 characters. Trouble ticket frequency and size are worst case.

To determine DDTS sizing requirements, the frequency non-conformance reports (NCRs) are generated on a daily basis was identified with the report size. A NCR was evaluated due to its similarity to a configuration change request (CCR). The number of CCRs generated at the DAAC sites are not considered to be more then necessary in a developmental environment.

There are expected to be approximately 16 periodic reports that will be produced on a daily, weekly, monthly and annual basis. Reporting areas include data production, fault identification, user accesses, resource utilization, user services activity and trouble ticketing. The size of an average report is estimated to be 15 KB. The aggregate number of reports generated is approximately 1 per hour.

The cumulative datastores of XRP, ILM, billing & accounting client, training management, and policy & procedures was estimated based on vendor provided information and experience in the development facility.

Disk space requirements of the MSS management server COTS applications are listed in Table 3.4.2.8.1-8. These applications will be stored in RAID and available for download to local disk. The RAID device interface is Fast/Wide SCSI which offers application access times comparable with local disk.

Table 3.4.2.8.1-8. COTS Product Disk Requirements

COTS Product	Disk Requirement (MB)
HP DCE	73
HPOV Network Management	1,200
HPOV Fault Management	70
HPOV Perfview	70
HP Tools	25
HPOV Operating System	2,000
Tivoli	200
Trouble Ticket (Remedy)	20
ClearCase Client	1,000
Sybase Server	2,000
Accugraph	20
TOTAL	6,678

The storage requirement for the Sybase DBMS is estimated to be 453 MB, ClearCase 3.9 GB, Tivoli 114 MB, Remedy 2 MB, DDTS 7 MB, DBMS Report Generator 5 MB, and 145 MB for all other datastores combined. Storage requirements for DCE directory and security stores are based on the number of predicted users as provided by user modeling. The total storage requirement for CSS is estimated to be 496 MB for Release B as specified in Table 3.4.2.8.1-9.

Additional RAID storage is allocated for disk mirroring of HP Openview functions and storage of billing and accounting transaction logs. Other real time functions (i.e. Tivoli and Remedy) will be replicated to the CSS server. A copy of all management data will be stored in RAID on a daily basis and safestored into a DLT tape drive via the management backup server. As required, the management data will then be stored into ECS data server archive.

The total storage requirement for Release B is estimated to be between 14 and 16 GB as specified in Table 3.4.2.8.1-10 (includes additional storage for Sybase swap space).

Table 3.4.2.8.1-9. ORNL CSS Release B Storage Requirement

CSS Data Store	# of Users	Size of Record (# Bytes)	14-Day Storage Requirements (MB)
DCE Directory	17,000	1,000	238
DCE Security	17,000	1,000	238
Mail	348	4,000	20
Total Storage Requirement			496

Table 3.4.2.8.1-10. ORNL MSS Release B Storage Requirements (1 0f 2)

Datastore	Freq. of Events/Hr	Size in Bytes/ Transaction	Size in Bytes Transmitted/Hr	14-Day Storage Requirements (MB)
HP Openview Datastore	60,357	5	301,785	102
Application log files	698	420*	305,760	104
Sybase DBMS				453
ClearCase				3,942
Tivoli	1320	256	337,920	114
Remedy	17	256	4,352	2
DDTS	8	2400	19,200	7
DBMS Report Generator	1	15,000	15,000	5

Table 3.4.2.8.1-10. ORNL MSS Release B Storage Requirements (2 0f 2)

Datastore	Freq. of Events/Hr	Size in Bytes/ Transaction	Size in Bytes Transmitted/Hr	14-Day Storage Requirements (MB)
Other Datastores (ILM, XRP, B&A client, training, policy & procedures)				145
Application Disk Space Requirements				6,678
Total Storage Requirement				11,552

*Application polling generates 512 byte logs. These have been included in the per hour total.

Processor Selection — Choice of the MSS/CSS Server platform was based on Release B processing requirements, COTS to be hosted on the platform, and price/performance data provided by EDS. Based on the Release B processing requirements, a medium-range server class platform was chosen. HP is the preferred vendor, since HP Openview and OODCE will be principal COTS products on these platforms, and HP is one of the principal developers of DCE and OODCE.

3.4.2.8.2   Configuration

The following configuration will be provided for the ORNL LSM for Release B, which includes the MSS MHWCI and the CSS DCHWCI.

- MSS Local Management Server and CSS Communications Server: 2 HP 9000 J210/2 processors, rated at 176 MIPS, 384 MB of RAM and 4 GB of storage.

- RAID Storage: 28 GB total storage

- Workstations:

  - 1 Sun SPARC 20/50 with 130 MIPS, 128 MB of RAM and 8 GB of storage (This workstation will house configuration management software)

  - 1 Sun SPARC 20/50 with 130 MIPS, 128 MB of RAM and 4 GB of storage

- Management Data Backup Server

  - 1 Sun Ultra 4-slot with 128 MB of RAM and 4 GB of storage

- Printer

  - 1 HP Laser Jet 4M+ Printer, 12 ppm/14 MB

The ORNL DAAC will contain two primary servers for its LSM configuration, cross-strapped to RAID disk to enable warm backup. MSS and CSS applications will run on separate systems but in case of contingency, either system will be capable of running both subsystems.

305-CD-037-002

The HP 9000 J210 is a high performance processor specifically designed for compute intensive and graphic applications. It includes a 176 MIPS processor which supports our requirements of less than 164 MIPs for Release B as shown in Table 3.4.2.8.1-4.

The configuration at ORNL will include two Sun SPARC 20/50 workstations. One of the workstations which will house configuration management software will be configured with higher memory and higher storage (128 MB of RAM and 8 GB of hard drive).

The DAAC configuration for ORNL includes a Digital Linear Tape (DLT) Library which implements helical scan technology which averages 20GB storage capacity per cartridge with a data transfer rate of about 3 MB/second.

3.5 Software/Hardware Mapping

With the exception of the Client subsystem, each subsystem has been designed to incorporate hardware CIs that include the components (processors, servers, archive robotics, etc.) on which the software components run. Table 3.5-1 provides a mapping of ORNL ECS Release B software components to the applicable hardware components.

Table 3.5-1. ORNL Hardware to Software Component Mapping (1 of 5)

HWCI/Units	Subsystem	CSCI	CSC
ACMHW/administration and operations workstations	Client	DESKT	All CSCs
		WKBCH	All CSCs, except - User Registration Tools
	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	Management	MACI	All CSCs
		MCI	Automatic Actions Fault Management Management Proxy Performance Management Performance Management Proxy

Table 3.5-1. ORNL Hardware to Software Component Mapping (2 of 5)

HWCI/Units	Subsystem	CSCI	CSC
ACMHW/APC servers	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	Data Server	SDSRV	All CSCs
	Ingest	INGST	All CSCs
	Management	MACI	All CSCs
		MCI	Automatic Actions Fault Management Management Proxy Performance Management Performance Management Proxy
DRPHW/DBMS servers	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	Data Server	SDSRV	DB Wrappers (Illustra DBMS)
	Management	MACI	All CSCs
		MCI	Automatic Actions Fault Management Management Proxy Performance Management Performance Management Proxy
DDSHW/document server	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	Data Server	DDSRV	All CSCs
	Management	MACI	All CSCs

Table 3.5-1. ORNL Hardware to Software Component Mapping (3 of 5)

HWCI/Units	Subsystem	CSCI	CSC
		MCI	Automatic Actions
			Fault Management
			Management Proxy
			Performance Management
			Performance Management Proxy
DMGHW/data specialist workstations	Client	DESKT	All CSCs
		WKBCH	All CSCs
	Communication	DCCI	Electronic Mail Services
			Event Logger Services
			File Access Services
			Life Cycle Services
			Message Passing Services
			Thread Services
			Time Services
	Management	MACI	All CSCs
		MCI	Automatic Actions
			Fault Management
			Management Proxy
			Performance Management
			Performance Management Proxy
DMGHW/administration and operations workstations	Client	DESKT	All CSCs
		WKBCH	All CSCs
	Communication	DCCI	Electronic Mail Services
			Event Logger Services
			File Access Services
			Life Cycle Services
			Message Passing Services
			Thread Services
			Time Services
	Management	MACI	All CSCs
		MCI	Automatic Actions
			Fault Management
			Management Proxy
			Performance Management
			Performance Management Proxy

305-CD-037-002

Table 3.5-1. ORNL Hardware to Software Component Mapping (4 of 5)

HWCI/Units	Subsystem	CSCI	CSC
DMGHW/DBMS servers	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	Data Management	DDICT	All CSCs
		DIMGR	All CSCs
		GTWAY	All CSCs
		LIMGR	All CSCs
	Interoperability	ADSRV	All CSCs
	Management	MACI	All CSCs
		MCI	Automatic Actions Fault Management Management Proxy Performance Management Performance Management Proxy
MSS/MSS workstations	Client	DESKT	All CSCs
		WKBCH	All CSCs
	Communication	DCCI	Electronic Mail Services Event Logger Services File Access Services Life Cycle Services Message Passing Services Thread Services Time Services
	ISS	INCI	All CSCs
	Management	MACI	All CSCs
		MCI	All CSCs
		MLCI	All CSCs
		MHCI	All CSCs
MSS/MSS LSM Server	ISS	INCI	All CSCs
	Management	MACI	All CSCs
		MCI	All CSCs
		MLCI	All CSCs
		MHCI	All CSCs

305-CD-037-002

Table 3.5-1. ORNL Hardware to Software Component Mapping (5 of 5)

HWCI/Units	Subsystem	CSCI	CSC
	Communication	DCCI	Electronic Mail Services
			Event Logger Services
			File Access Services
			Life Cycle Services
			Message Passing Services
			Thread Services
			Time Services
CSS/CSS server	Communication	DCCI	All CSCs
	Management	MACI	All CSCs
		MCI	Automatic Actions
			Fault Management
			Management Proxy
			Performance Management
			Performance Management Proxy
User workstation	Client	WKBCH	All CSCs
		DESKT	All CSCs
	Ingest	INGST	User Network Ingest Interface

Note: "All CSCs" refers to those CSCs for a specific CSCI that is identified in the Component Analysis Table in Section 3.3.2 of this document.

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4. Future Releases

This document has described the design of ECS subsystems for the ORNL ECS DAAC at Release B. Two other releases are currently planned. The next release, Release C, is scheduled for December 1999. The Release Plan Content Description for the ECS Project describes in detail the capabilities being provided in Releases C and D. In summary, Release C will provide evolutionary enhancements to Release B, Flight Operations for EOS PM1, and the CORBA and Trader implementations. An updated version of this document will precede Release C and will reflect the design corresponding to that release.

305-CD-037-002

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Abbreviations and Acronyms

ACMHW	Access Control and Management HWCI
ACRIM	Active Cavity Radiometer Irradiance Monitor
ADC	Affiliated Data Center
ADEOS	Advanced Earth Observing System (Japan)
ADS	Archive data sets
ADSHW	Advertising Service HWCI
ADSRV	Advertising Service CSCI
AHWGP	Ad Hoc Working Group on Production
AITHW	Algorithm Integration & Test HWCI
AITTL	Algorithm Integration and Test Tools (CSCI)
AM	Ante meridian
AM-1	EOS AM Mission spacecraft 1, morning spacecraft series
ANSI	American National Standards Institute
APC	Access/Process Coordinators
API	Application Programming Interface
APID	Application Process Identifier
AQAHW	Algorithm QA HWCI
AS	Administration Stations
ASAP	As soon as possible
ASCII	American Standard Code for Information Interchange
ASF	Alaska SAR Facility (DAAC)
ATBD	Algorithm theoretical basis document
ATM	Asynchronous Transfer Mode
B&A	Billing and Accounting
BAAC	Billing and Accounting
BOREAS	Boreal Ecosystem Atmospheric Study

305-CD-037-002

CCR	Configuration Change Request
CCSDS	Consultative Committee for Space Data Systems
CD ROM	Compact disk read only memory
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CERES	Clouds and Earth's Radiant Energy System
CI	Configuration Item
CIDM	Client, Interoperability and Data Management
CIESIN	Consortium for International Earth Science Information Network
CLS	Client Subsystem
CM	Configuration Management
COLOR	EOS Color Mission
CORBA	Common Object Request Broker Architecture
COTS	Commercial off-the-shelf
CPU	Central processing unit
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CSDT	Computer Science Data Types
CSMS	Communications and Systems Management Segment
CSS	Communication Subsystem (CSMS)
DAAC	Distributed Active Archive Center
DAO	Data Assimilation Office
DB	Database
DBA	Database administrator
DBMS	Database Management System
DCCI	Distributed Computing Configuration Item
DCE	Distributed Computing Environment
DCHWCI	Distributed Computing Hardware Configuration Item
DDICT	Data Dictionary CSCI

DDIST	Data Distribution CSCI
DDTS	Distributed Defect Tracking System
DDSRV	Document Data Server CSCI
DDTS	Distributed Defect Tracking System
DESKT	Desktop CI
DEV	Developed code
DID	Data Item Description
DIM	Distributed Information Manager
DIMGR	Distributed Information Management CSCI
DIPHW	Distribution & Ingest Peripheral Management HWCI
DMGHW	Data Management HWCI
DMS	Data Management System
DMS	Data Management Subsystem
DOE	Department of Energy
DOF	Distributed Object Framework
DP	Data Processing
DPR	December Progress Review
DPREP	Science Data Pre-Processing CSCI
DPS	Data Processing Subsystem
DR	Data Repository
DRPHW	Data Repository HWCI
DS	Data Server
DSM	Distribution Storage Management
DSS	Data Server Subsystem
DT	Data Type
EBnet	EOSDIS Backbone network
ECS	EOSDIS Core System
EDC	EROS Data Center (DAAC)
EDF	ECS Development Facility

EDHS	ECS Document Handling System
EDS	Electronic Data Systems (ECS Team)
EDOS	EOS Data and Operations System
EGS	EOS Ground System
EOC	EOS Operations Center (ECS)
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
EP	Evaluation Package
EP	Early Prototype
ERS	European Remote-Sensing Satellite
ESDIS	Earth Science Data and Information System
ESDT	Earth Science Data Types
ESnet	Energy Science network
F&PRS	Functional and Performance Requirements Specification
FC	Fiber Channel
FDDI	Fiber distributed data interface
FDF	Flight Dynamics Facility
FIFE	First ISLSCP Field Experiment
FOO	Flight Of Opportunity
FOS	Flight Operations Segment
FSMS	File and Storage Management System
Ftp	File transfer protocol
FWD	Fast/Wide
GB	Gigabyte
GCMD	Global Change Master Directory
GDAO	GSFC Data Assimilation Office
GFE	Government Furnished Equipment
GFLOPS	Giga (billions) Floating Point Operations per Second
GOES	Geostationary Operational Environmental Satellite

GRIB	Gridded Binary
GSFC	Goddard Space Flight Center
GTWAY	Version 0 Interoperability Gateway CSCI
GUI	Graphic user interface
HDF	Hierarchical Data Format
HiPPI	High Performance Parallel Interface
HMI	Human machine interface
HP	Hewlett Packard
HPOV	HP Openview
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HW	Hardware
HWCI	Hardware Configuration Item
I&T	Integration and Test
I/O	Input/Output
IAS	Image Assessment System
IATO	Independent Acceptance Test Organization
ICD	Interface Control Document
ICLHW	Ingest Client HWCI
IDL	Interface Definition Language
IDR	Interim Design Review
IEEE	Institute of Electrical and Electronics Engineers
IERS	International Earth Rotation Service
IGS	International Ground Station
ILM	Inventory/Logistics/Maintenance
IMS	Information Management System
INCI	Internetworking CI
IOS	Interoperability Subsystem
IP	International Partner

IR-1	Interim Release 1
IRD	Interface Requirements Document
IS	Ingest Subsystem
ISLSCP	International Satellite Land Surface Climatology Project
ISS	Internetworking Subsystem
IST	Instrument Support Terminal (ECS)
IV&V	Independent Verification and Validation
JERS	Japanese Earth Remote-Sensing Satellite
JPL	Jet Propulsion Laboratories
KB	Kilobytes
LAN	Local Area Network
LANDSAT	Land Remote-Sensing Satellite
LaRC	Langley Research Center
LIM	Local Information Manager
LIMGR	Local Information Management CSCI
LIS	Lightning Imaging Sensor
L0	Level 0
LSM	Local System Management
M&O	Maintenance and Operations
MACI	Management Agent CI
MB	Megabyte
Mbps	Megabits per second
MBps	Megabytes per second
MCI	Management CI
MD	Maryland
MFLO	Millions of Floating Point Operations
MFLOP	Millions of Floating Point Operations per Second
MHWCI	Management Hardware Configuration Item
MIB	Management Information Base

MIPS	Million Instructions Per Second
MLCI	Management Logistics CI
mm	Millimeter
MOC	Mission Operations Center
MODIS	Moderate-Resolution Imaging Spectrometer
MPP	Massively Parallel Processor
MRF	Medium Range Forecast
MSFC	Marshall Space Flight Center
MSS	Management Subsystem (CSMS)
MTBF	Mean time between failures
MTTR	Mean time to restore
NASA	National Aeronautics and Space Administration
NCR	Nonconformance Report
NESDIS	National Environmental Satellite Data and Information Service
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NPP	Net Primary Production
NSIDC	National Snow and Ice Data Center (DAAC)
O/A	Orbit/Attitude
ODC	Other Data Center
ODL	Object Description Language
OODCE	Object Oriented DCE
ORNL	Oak Ridge National Laboratory (DAAC)
OS	Operating System
OSM	Open Storage Manager
OTS	Off-the-shelf
OTTER	Oregon Transect Ecosystem Research Project
PAM	Permanent Archive Manager
PCI	Peripheral Component Interface

PDPS	Planning and Data Processing System
PDR	Preliminary Design Review
PDS	Production Data Set
PDS	Production Data Specialist
PGE	Product Generation Executive
PGS	Product Generation System
PLNHW	Planning HWCI
PM1	EOS Afternoon Crossing Mission
POSIX	Portable Operating System for UNIX
ppm	Pixels Per Minute
PRONG	Processing CSCI
Q	Quarter
Q/A	Quality Assurance
QA	Quality Assurance
QAC	Quality and Accounting Capsule
RADARSAT	Radar Satellite (Canada)
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory
RDBMS	Relational Database Management System
REL	Release
RID	Review Item Discrepancy
RMA	Reliability, Maintainability, Availability
RTF	Rich Text Format
RRR	Release Readiness Review
S/C	Spacecraft
SAA	Satellite Active Archives (NOAA)
SAGE	Stratospheric Aerosols and Gas Experiment
SAR	Synthetic Aperture Radar
SCDO	Science and Communications Development Office (ECS)

SCF	Science Computing Facility
SCSI II	Small Computer System Interface
SDF	Software Development File
SDP	Science Data Processing
SDPF	Sensor Data Processing Facility (GSFC)
SDPS	Science Data Processing Segment
SDPS/W	Science Data Processing Software
SDPTK	SDP Toolkit CSCI
SDSRV	Science Data Server CSCI
SFDU	Standard Format Data Unit
SMC	System Monitoring and Coordination Center
SMP	Symmetric Multi-Processor
SNMP	Simple Network Management Protocol
SPRHW	Science Processing HWCI
SQL	Structured Query Language
STMGT	Storage Management CSCI
SW	Software
TBD	To be determined
TME	Tivoli Management Enterprise
TBR	To be resolved
TDRSS	Tracking and Data Relay Satellite System
TONS	TDRSS Onboard Navigation System
TPM	Transaction Per Minute
TPS	Transaction Processing speed
TPS	Transaction Per Second
TRMM	Tropical Rainfall Measuring Mission
TRR	Test Readiness Review
TSDIS	TRMM Science Data and Information System
UR	Universal Reference

USNO   United States Naval Observatory

V0   Version 0

VC   Virtual Channel

VCDU-ID   Virtual Channel ID

VOB   Virgin Object Base

WAIS   Wide Area Information Servers

WAN   Wide Area Network

WKBCH   Workbench CI

WKSHC   Working Storage HWCI

W/S   Workstation

WORM   Write Once Read Many

WS   Working Storage

WWW   World Wide Web